LEARNING - MEMORY PROCESSES IN THE CLASSROOM

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ABSTRACT

This research involved two studies concerned with pupils' learning and retention of written material in the classroom. Ss being Form I intermediate school pupils. The major study involved structured interviews, following pupils' study of a written passage; to determine their knowledge of their own learning-memory processes, the strategies which they use when attempting to learn and remember written material, and the effect of these two factors on recognition and recall, after a 4 week and 5 day retention period.

The subsidiary study compared the relative effectiveness of learner formulated strategies and three experimenter imposed strategies (the later groups having no knowledge of a post-test) on retention, over 2 weeks and 6 days. The effect of pupils' reading comprehension-vocabulary levels and the differences between recognition and recall were also considered.

The results suggest that Form I pupils have a somewhat sketchy basic knowledge of factors influencing learning and retention but often have trouble expressing this knowledge and seldom use it in a planned way. No definite conclusions were reached on the relative effectiveness of various study strategies, but the need for meaningful processing, by some means, was emphasized. The effect of the extent of pupils' established knowledge of the to-be-remembered material, on learning and retention, was also noted. The results show the important part teacher instructions can play in determining the effectiveness of pupils' learning and retention in the

classroom. However it is the learner who has ultimate control over the depth at which processing takes place.

CHAPTER I

INTRODUCTION

I. CONTEXT OF THE PROBLEM

Implicit in any educator's belief, is that he must somehow teach his class to retain the information he is giving them (and that which they are discovering for themselves). There is as yet little research which would help the educator teach such skills. There is in fact little research which would even suggest what these skills may be, in the classroom situation.

There are to date a number of models of memory (Atkinson and Shiffrin, 1968; Montague, 1972) which illustrate the important part played by the processor in learning-memory tasks. In such models the processor organizes or encodes material into a form that is understandable to himself and which facilitates retrieval at the appropriate time.

The concept of organization in memory is by no means a new one; in 1940 Katona suggested that organization in memory involves the formation and perception of groupings and their relations. Since then there have been numerous studies of various aspects of encoding and organization. These include studies of clustering (Bousfield, 1953; Battig, 1966); chunking (Miller, 1956; Mandler, 1967); subjective organization (Tulving, 1962); experimenter imposed organization (Bower, 1970); natural language mediation (Montague, Adams and Kiess, 1966); developmental shifts in encoding processes (Flavell et al, 1966; Flavell et al,

1970; Bach and Underwood, 1970; Rossi and Wittrock, 1971). The design of the studies cited however, makes it difficult to generalize their findings to the classroom situation. The majority of these studies used as their learning-memory task, either paired associate learning or free recall of word lists; neither of which activities are likely to be performed very often, outside the experimental situation. There is also a tendency in such studies, to concentrate on the short term effects of encoding (or processing). Furthermore, there is a tendency towards tightly controlled laboratory studies.

To my knowledge, as yet, no study has looked at the use and effect of learning-memory strategies in the classroom situation.

II. PURPOSE OF THE STUDY

It was the purpose of the present study to determine:

(i) The strategies used by Ss in learning and remembering, meaningful written material, in the classroom.

(ii) The effect of antecedent conditions and strategy use, on S's subsequent recall and recognition of the important points from the written passage.

(iii) S's ability to predict their own state of retention after a four week retention period.

(iv) S's knowledge of their own memory processes.

III. LEARNING AND MEMORY

(1) The Nature of Memory

Memory is "a label, a concept used to indicate that people do retain information.....The word memory is used to

denote a capacity to remember; it is not an explanation for remembering." (Howe, 1970, Pp 3-4). It is indeed, not within the scope of this thesis to attempt to formulate a comprehensive explanatory theory of the information processing mechanisms involved in learning and memory. This thesis is however based on certain assumptions about 'memory', which must be made clear.

The evidence for a multi-stage model of memory is accepted by this author and in fact underlies a number of the premises of this thesis. At the same time however it is important not to look at this thing labelled 'memory', in isolation. Memory cannot be divorced from other cognitive processes, as it is itself an integral part, a particular dimension, of applied cognition. This view is now held by a number of researchers: "memory is in good part just applied cognition ... memory seems mostly to be just a matter of the head doing its characteristic 'thing' while coping with the specific task of storing or retrieving factual information ideas and other cognitive contents." (Flavell, 1971, P273). "In the broad sense, memory ... is just another mode of knowledge ... a mode of knowledge that is not concerned with present data, as is perception, nor with the solution of new problems, as is intelligence in its specific function, but with the structuring and reconstitution of the past." (Piaget et al, 1968; translated by Flavell, 1971, P273). As Flavell states when referring to memory development; effective memory involves intelligent structuring and storage of input, intelligent search and retrieval operations and intelligent monitoring and knowledge of these storage and retrieval operations (Flavell, 1971, P277).

(2) Model of Memory

The theory of memory implicitly accepted in this paper, is one of interference; i.e., everything stored in long term memory (L.T.M.) is permanent, but some material inhibits the retention of other material. Support for this theory comes from various sources: (a) fluctuations in memory with verbal learning tasks; (b) recall of past events in vivid detail during psychotherapy; (c) experiments showing greatly reduced memory loss when interference is reduced to a minimum; (d) Penfield's work showing that electrical stimulation of the brain can result in detailed recall of past events.

Research evidence has also led many experimenters to conclude that there are three major stages of memory: sensory register (S.R.), short term store (S.T.S.), and long term store (L.T.S.). The existence of a S.R. seems to be a well established and accepted phenomena. The research findings which point to a need to distinguish between S.T.M. and L.T.M. can be summarized as follows: (a) differences in durability of memory traces; (b) differences in the nature of interference; (c) differences in capacity of the two systems; (d) physiological evidence provided by Milner (1959, 1966, 1968) (cited by Atkinson and Shiffrin, 1968, P97).

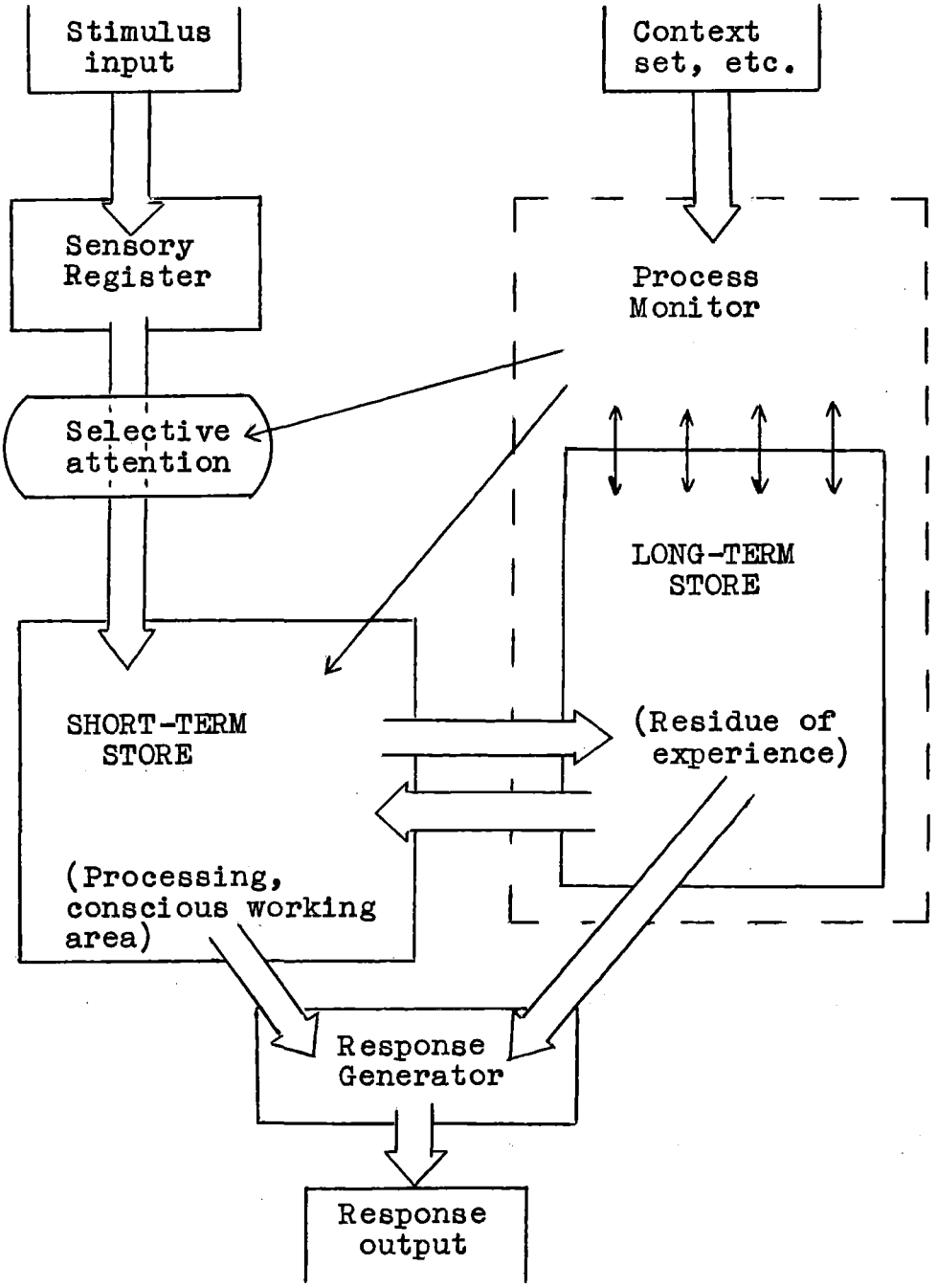
These findings strongly suggest that a different part of the brain is concerned with learning and storing new information (or perhaps retrieving new information), than that which caters for the storage and retrieval of established information.

The model of memory presented here (see Figure I) incorporates aspects of Shiffrin and Atkinson's (1969) model and that of Montague (1972). Basically, Figure I shows that the relatively large amount of information received by the sensory register is 'filtered' or 'selected' according to instructor or subject biases and only a limited amount gets transferred into the S.T.S. The S.T.S. is the conscious working memory, where incoming material interacts with the content of the L.T.S. and is processed for response construction or for return to the L.T.S. Behind the operations of these processes lies a process monitor which exercises control over such functions as attention, memory search and response evaluation. The mechanism of transfer of some of the material from the S.T.S. into the L.T.S. is not perfectly clear. It is on the processor controlled use of such encoding and transfer processes, that this thesis attempts to throw some light.

Memory research has itself been influenced by the distinction between short and long term memory, to the extent that two basically different research designs have developed (one for S.T.M. and one for L.T.M.). Although the distinction is not laboured in the present study, the nature of this research problem has resulted in a design, similar to those used with L.T.M. research.

The value of a model of memory, such as that presented here, to the study of memory processes and strategies used by pupils in remembering written classroom material is: Firstly, it points to the significance of encoding and transfer processes in storing information in L.T.M. It shows that the

FIG. I A Model of Learning and Memory Processes



learner plays an active role in selecting and processing to-be-remembered material. Furthermore, if this model and the permanence of material in L.T.M. are accepted, then the storage and retrieval processes and strategies, used by Ss, become a paramount consideration for classroom learning and memory.

(3) Encoding Processes and Memory Strategies

There is general acceptance, that active processing (encoding) of new material is necessary for its storage in L.T.M. "There seems little reason to question the empirical role of elaborative strategies in memory tasks." (Montague, 1972, P293). "No disagreement exists about whether memory is organized; the problem is what is the mechanism that brings the organization about" (Kendler, 1966, P198).

Atkinson and Shiffrin (1968, P118) list five ways in which encoding may facilitate performance.

(i) Make use of strong pre-existing associations thus eliminating the necessity of making new ones.

(ii) Decrease the effective area of memory to be searched at the time of the test.

(iii) Give some order to an otherwise random search.

(iv) Increase the amount of information stored.

(v) Protect fledgling associations from interference by succeeding items.

This then is the focus of the present study. By what means do pupils process to-be-remembered material in the classroom situation? What elaborative strategies do they use and what are the consequences? Do some strategies produce better retention for all situations or do effective strategies vary with characteristics of the processor and of

the to-be-remembered material?

In subsequent discussion the terms 'processing' and 'encoding' will be used (often interchangeably) in references to the same phenomena; i.e. any strategies S's use or any operations they perform, when attempting to learn and remember given material. Processing often involves S in modifying (selectively altering or elaborating) to-be-remembered material in terms of what he/she already knows.

Of major interest to this thesis are the strategies used by Ss to facilitate encoding. Atkinson and Shiffrin refer to these strategies as 'control processes'; that is, "processes that are not permanent features of memory but are instead transient phenomena under the control of the subject; their appearance depends on such factors as instructional set, the experimental task, and the past history of the subject" (Atkinson and Shiffrin, 1968, P106). It is the use of such control processes, or strategies, as they will be referred to in this paper, that determines the extent and form of transfer to the L.T.S.

(4) The 'Intent to Learn' and Meaningful Processing

The emphasis of this paper is on the active role of the processor in learning and memory. As Howe points out, "when the material is meaningful and important to a person ... its retention becomes increasingly less dependent upon the function of the memory system and increasingly more dependent upon factors such as perceived importance, interest, and comprehensibility of material, which must be defined in terms of the individual's background: ..." (Howe, 1970, P77).

Recent researchers (Anderson, 1970; Montague, 1972;) suggest that S may process material either superficially or more comprehensively according to the perceived or stated task demands. Thus the 'intent to learn' or 'intent to remember' is an important factor in retention. The intentional learner is more likely to store additional attributes via comprehensive encoding, which in turn facilitates retrieval. The intent to remember is however not necessary for comprehensive encoding. "The mature learner who intends to learn will usually complete the operations required to learn, but an intention to learn is unnecessary if the task itself requires full processing." (Anderson and Hidde, 1971, P528-9).

It would thus seem that successful learning and retention should be achieved if either the task demands and/or the motivational state of S result in meaningful processing.

The concepts of 'meaning' and 'meaningful processing' play an important part in learning-memory theories (Ausubel, 1968; Bower, 1970; Montague, 1972). Meaningful processing being, the act of applying meaning to the written word in terms of S's established knowledge base. It is the forming of an association between the written material and an internal representation. Thus written material is meaningful for S if he/she can relate it to his/her existing cognitive structure.

Numerous studies (Bobrow and Bower, 1969; Anderson and Hidde, 1971; Anderson et al, 1971) have shown that S's performance is superior if the task demands require meaningful

processing and comprehension, when compared with performance of Ss whose task demands do not require such processing.

(5) Learning / Retention

The concepts of 'learning' and 'retention' will be used often in this thesis; their use must therefore be defined.

(a) Learning refers to the process of acquiring meanings from potential meanings represented in the learning material.

(b) Retention refers to the process of maintaining the availability of the new meanings or some part of them (Ausubel and Robinson, 1969, P105).

Although such a differentiation can be made between 'learning' and 'retention'; in practice one is unlikely to take place without the other. Learning it would seem is a logical prerequisite for retention and implicit in learning is the intent to retain the material. Furthermore, many of the mechanisms and processes involved in learning are those which influence retention. The processes carried out at the time of learning, play a large part in determining the quality and quantity of storage of material in L.T.M. and thus its later retrievability. Therefore, in this paper, the processes involved in learning and memory are considered together; as any attempt to differentiate them would prove highly superficial.

(6) Recognition / Recall

Retention is typically measured in one of two ways; by recognition or recall. In the recall situation the subject attempts to repeat (duplicate) a response learned earlier. In the recognition situation the subject attempts

to identify the 'criterion event' from among alternatives. A further means of measuring retention, is that of measuring the rate at which relearning takes place.

This distinction raises the question of whether recognition involves the same processes as recall. One view held by a number of researchers, is that the problem of access to stored information exists only for recall, not for recognition memory tasks (Murdock, 1968; Bower et al, 1969). "The basic difference between recall and recognition appears to be that recall involves a search process and recognition does not" (Kintsch, 1970, P337). "In recall a part of the memory must include mechanisms for retrieval; this is simply not the case for recognition" (Underwood, 1972, P6).

However this author, as do Tulving and Thomson (1971), finds it difficult to accept that there is somehow automatic access to stored information in recognition memory tasks. Surely, recognition must involve retrieval of stored information, if a meaningful discrimination is to be made between alternatives. Light and Carter-Sobell (1970), suggest that the difference between recall and recognition mechanisms may well be exaggerated by the fact that studies to date, have typically involved the retention of unmodified words (in a context free situation). Furthermore, it may well be that recognition and recall result in S performing different operations when retention is tested; this however does not necessarily reflect a process distinction.

The major difference between recall and recognition would seem to be, not in the intrinsic nature of the processes

involved, but the number and nature of the retrieval cues present at testing. Traditionally the recognition test provides 'superior' cues (and thus superior performance), through the presence of the correct answer and a limited number of false alternatives. However, "Recall is higher than recognition whenever retrieval cues present at the recall test are more effective in providing access to stored information than are retrieval cues present at the recognition test" (Tulving, 1968, P54).

(7) Memory Strategies and Metamemory

Flavell, Friedrichs, and Hoyt (1970) have studied developmental changes in memorization processes in school children, from nursery to 4th grade. (The task used, was to memorize a series of object pictures which became illuminated in the windows of a stimulus panel when S pressed the button beneath the picture.)

They were concerned not only with memory strategies, but also with 'metamemory', the subject's knowledge of their own memory. With regard to the later, they found that older Ss were better able to predict their own memory span in advance of any concrete memorization experience and to assess their readiness to recall after such an experience. With regards to strategy use, only older Ss tended to show a specific memorization strategy. They first named the items to themselves to initiate the learning process and subsequently used systematic anticipation (say object, then press button to check) and rehearsal procedures (naming an object when not actually observing it), to monitor and maintain a gradually increasing state of recall readiness. These

results suggest that older Ss are likely to use a form of self-testing during learning, to check their state of recall readiness and as a means of rehearsing for the anticipated test.

This however was a highly controlled laboratory study using pictorial material, in which there was little opportunity for Ss to show responses other than those being studied. It is doubtful whether the results of a study such as this can be applied to the classroom setting. Are such memory strategies used in children's classroom learning? If these processes are not used, which are? These are questions on which the present study attempts to throw some light.

In a study by Mary Kreutzer et al (1975), 20 children at each grade K, 1, 3, 5 were interviewed in order to determine the extent of the children's metamemory. Metamemory is described as: "the child's verbalizable knowledge of how certain classes of variables act and interact with one another to affect the quality of an individual's performance on a retrieval problem" (Abstract). Kreutzer et al see at least three broad and overlapping categories of such variables.

(i) The person himself. The child has to construct a differentiated conception of himself and others as mnemonic beings. He needs to develop intuitions about the capacities, limitations, and peculiarities of the human system.

(ii) The data and task demands involved in retrieval problems.

(iii) The acquiring of a repertoire of deliberate and conscious memory strategies.

Finally the mnemonically sophisticated individual comes to know that these variables always interact with one another in complex ways.

Kreutzer et al studied 14 aspects of metamemory, some examples of which will be mentioned in this summary of their findings. The results tentatively suggest that even children as young as 5 years old, often realize that decay from S.T.M. is very rapid; that relearning of forgotten information is quicker than learning completely new material; that retrieval performance is affected by amount of prior study time, by the nature of the material and especially by the number of items to be retrieved. Both younger and older Ss showed a tendency to think of 'external' mnemonic resources e.g. written records and other people.

Children of grade 3 and especially grade 5 appeared considerably more planful and self aware in their approach to a wider range of problems and had command of a wider variety of solution strategies. They showed a more differentiated concept of self and others as mnemonic organisms and a better understanding of how relations among items can variously facilitate or interfere with retrieval.

On the basis of these findings it would be expected that the Ss in the present study (Form I) would have a well developed knowledge of how various variables affect their memory state.

In his commentary of Kreutzer et al's paper, John Hagen points out that the study demonstrates the immense value of the structured interview technique. He also points

to the problem arising from the considerable emphasis on verbal skills involved in such a technique. Both a majority of the memory tasks involved and reporting to the interviewer, may involve verbal skills not yet developed in the younger and/or verbally less able Ss, thus resulting in an underestimation of their use of deliberate memorizing.

Hagen also makes another comment pertinent to the present study. "While the range of memory phenomena covered in the interviews is extensive, one cannot conclude that the children's views on how they would solve memory tasks actually correlate with their performance in tasks that require mnemonic skills. Clearly future investigators will want to study the relationship between metamemory and performance on memory tasks, in order to demonstrate the applicability and generality of the protocols obtained from this type of interview." (P60)

The study presented in this thesis follows this proposal. It compares S's reported use of memory strategies with subsequent performance on a retention test. It also makes use of the structured interview technique. If meaningful information is to be gained from this kind of interview, S must have, and be able to express, at least a basic understanding of his own memory system. The problems arising from the verbal bias of such a research design were not overcome in the present study, but its effect was given full consideration.

At this point it would seem appropriate to take heed of a warning made by Pylyshyn. "Just because we 'know' that we use certain mnemonic strategies, or that we say certain

things to ourselves or that we 'see' certain objects in our 'mind's eye' or 'hear' ourselves rehearsing a series of numbers etc, we cannot assume that the content of such subjective knowledge can be identified with the kind of information processing procedures which will go into an explanatory theory." (Pylyshyn, 1973, P3).

IV HYPOTHESES

The general nature of a number of the stated hypotheses reflects the exploratory nature of much of this study.

The following hypotheses were made:

1. (a) Ss will enter the learning-memory situation with differing antecedent experiences, interests and abilities which may influence performance in the learning-memory situation.

(b) Ss will differ in the strategies they will use to process the material in the learning-memory situation.

(c) Differences in antecedents and strategy use, will affect S's retention of the to-be-remembered material.

2. Those Ss with superior retention will use different strategies from those with inferior retention.

3. Ss will be able to predict their degree of retention of the to-be-remembered material, immediately before the retention test.

4. Ss will be able to describe verbally, a basic knowledge of their own learning-memory processes and strategies.

V MAJOR STUDY VARIABLES

The first aim of this study was descriptive; to determine by the use of individual interviews, the strategies pupils used and the antecedent characteristics they brought to the learning-memory task. The task being the learning (reading, comprehension and storage), retention, and later retrieval, of the important points from a written passage on hurricanes and tornadoes.

The effect of strategy use and personal antecedent variables on the retention of the passage material over a 4 week and 5 day retention period was then determined.

Retention was measured by two post-tests:

(i) An open ended (O.E.) test, asking pupils to recall all they could about tornadoes and hurricanes.

(ii) An 11 item multiple choice (M.C.) test, on the passage.

Residual scores, with age, sex, I.Q., and P.A.T. Reading Comprehension scores partialled out, were also obtained on these two measures.

The Ss were also grouped according to post-test performance, to determine whether the 'high performers' on the retention tests showed a trend in strategy use and antecedent variables, not shown by the 'low performers'. Here raw scores on both the O.E. and M.C. tests were considered.

VI OPERATIONAL RESTATEMENT OF HYPOTHESES

Operationally there were a large number of predicted outcomes, which can be stated as follows:

1. There will be a positive correlation between
   (a) S's IQ as measured by the A.C.E.R. Intermediate D.
   (b) S's reading comprehension ability as measured by the P.A.T.

and (i) strategy use and antecedent characteristics.
(ii) test scores on both the O.E. and M.C. tests.

2. Those Ss whose antecedent interests and experiences provided contact with or information about hurricanes and tornadoes (or dangerous wind movements in general), as determined through the interview situation, will gain superior O.E. and M.C. post-test scores.

3. Those Ss who report that they understand the passage, without difficulty, will gain superior post-test scores.

4. Those Ss who: (a) report the necessity of taking 'special' steps if the important points from the written passage are to be learned and retained for a period as great as four weeks.

(b) have a preconceived idea of what the post-test will involve from them; will gain superior post-test scores.

5. Those Ss who report:-
   (a) Reading the passage several times.
   (b) Selectivity in re-reading the passage.
   (c) Note taking.
   (d) Selectivity in attempted retention.
   (e) Self questioning.

(f) Repeating over to oneself, parts of the passage.

(g) Association of passage material with established knowledge.

(h) Formation of pictorial images.

- will in the case of each strategy, gain superior post-test scores to those who do not use such strategies.

6. Parts of the passage which, when interviewed, Ss report as standing out in their mind, will have a high probability of recall on the O.E. post-test.

7. Ss will be able to predict, by indicating on a 5-point scale ('none' to 'nearly all'), their retention state immediately before sitting the post-tests. Also, these predictions will correlate positively with S's actual retention, as measured by the O.E. test.

8. Implicit in all hypotheses involving interview data is the belief that Ss will, through the interview situation convey to the experimenter:

(a) a knowledge of the use of certain learning-memory strategies.

(b) a basic knowledge of what the strategies involve.

(c) some understanding of why the use of such strategies may help learning and memory.

(d) a basic knowledge of what is involved in learning and remembering material over a period of time.

VII SIGNIFICANCE OF THE STUDY

If pupils are to be helped to learn and retain written material in the classroom, effective action must be based on a knowledge of: what pupils in fact do in such

learning-memory situations, their knowledge of their own memory processes and the effect the strategies which they use have on learning and retention. It is thus the purpose of this study to add to the as yet meagre knowledge of pupil use of learning-memory strategies in the classroom situation. Such knowledge will provide a basis for action in the classroom and for further, more strictly experimental, research.

The results of this research should not be considered conclusive as there were relatively few Ss (44 'full-data'), from only one school, and owing to the length of the retention period (4 weeks and 5 days) there were a number of uncontrolled variables. The study does however provide pertinent data on the strategies pupils are likely to use when learning and remembering written material in the classroom; the effect of such strategy use on the learning, storage and subsequent retrieval of the information; and finally provides some insight into pupils' knowledge of their own learning-memory processes.

CHAPTER II

FORMULATION OF THE INTERVIEW SCHEDULE

I. INITIAL EXPLORATORY STUDY

The initial work began with a very loosely structured exploratory study; the purpose of which was to ascertain the strategies used by pupils, of various ages, in learning and remembering written material in the classroom.

The Ss were 20 Standard 3 - Form II pupils at a two teacher country school. The method used was to present Ss with a passage entitled "Three Enemies of the High Country Farmer" (see Appendix A). Ss were then given 10 minutes to learn (and remember) the important points from the passage. A 'test atmosphere' was maintained throughout.

Following presentation and learning of the passage, 12 Ss, selected by the teacher so as to give a cross-section of ability at each class level, were interviewed individually. General questions were asked which were intended to give some insight into the strategies used by pupils, without prompting reports of strategy use merely to please the questioner. Sample questions were: "Did you have time to read the passage more than once?"; "Were there any special things you did to help you remember the important points?"; "Did reading the passage remind you of things you have seen at home or elsewhere?".

Following a $3\frac{1}{2}$ hour retention period, a test, consisting of 10 short answer, orally presented, factual

questions, was given.

The more important strategies mentioned by pupils in the interviews, were as follows:

(i) Use of pictorial imagery associated with certain parts of the passage.

(ii) Use of verbal thought about parts of the passage.

(iii) Association of passage material with established knowledge.

(iv) Attempted recall of the passage content in general, or of specific parts of the passage.

(v) Self-questioning about the content of the passage.

II. PILOTING THE DRAFT SCHEDULE

On the basis of the findings of the above exploratory study, further observations and interviews in Form I and Form II classes and the findings of other researchers (Pavio, 1969; Anderson, 1970; Flavell et al, 1970; Horowitz and Manelis, 1972; Montague, 1972), a draft interview schedule was formulated.

This interview schedule was tried out with a Form II class at Kirkwood Intermediate School. The suitability of the retention passage used in the major study was also tried out with this class. The passage, 'Dangerous Wind Movements', (see Appendix B.1.) was presented to an unstreamed Form II class, under test conditions. The Ss were given 15 minutes to read the passage and attempt to learn the important points. Then, using the draft schedule (see

Appendix C.1.), two interviewers interviewed a sample of fourteen pupils (seven girls and seven boys), individually. These interviews were recorded and later transcribed and analysed to assess the suitability of the interview questions for gaining an insight into the antecedent characteristics of the Ss and their use of learning-memory strategies. On the basis of this analysis the content of the interview questions was left unchanged, but in a number of cases the wording was altered slightly, to reduce the likelihood of pupils giving monosyllabic yes/no answers to the questions. It was also found that the indirect nature of the questioning was not sufficient to gain an interpretable response, in regards to the use of pictorial imagery, from some pupils. Thus a more direct question, (14, b) (see Appendix C.2.) was formulated to use as a back up question, in such cases. The resulting interview schedule is described below.

III FINAL INTERVIEW SCHEDULE

(1) How interesting did you find the passage?

It was hoped that this question would indicate the extent of pupil interest in the content of the passage (and indirectly, S's intent to remember). It was hypothesized that the more interested Ss would pay more careful attention (to more of the passage material) and thus process it at a deeper level. This would result in more accurate storage, of a greater number of attributes, which would in turn facilitate later retrieval.

(2) Have you done any previous reading about hurricanes and tornadoes?

This question was designed primarily to gain a measure of S's established knowledge base. The premise was that those Ss with the most extensive reading in this area, prior to the study, would have the most comprehensive knowledge base with which to associate passage material. This would allow for a more meaningful association, of a greater number of features of the passage material, with S's established knowledge; which would in turn facilitate later retrieval.

It was also presumed that previous purposeful reading on this topic would reflect an interest in the topic.

(3) Did you read all the passage more than once or just parts of it?

This question was to determine:

(a) the number of times Ss read the passage,

(b) whether Ss simply read the passage as a whole, over and over again; or whether after the initial reading they concentrated their reading on selected parts of the passage.

It was predicted that those Ss who were selective in their re-reading would be those reading with a purpose, thus those most likely to concentrate on the major points in the passage and to demand comprehension of what they read. They would thus gain a greater understanding of the passage, have more accurate storage and subsequently superior retrieval. (That is, so long as their selectivity was not taken to the extent of neglecting important parts of the passage.)

(4) Did you understand the passage or did you have some difficulties?

It was thought that Ss will only store information if it has some meaning for them in terms of their established knowledge base. Therefore those Ss having difficulties in understanding parts of the passage, may find it necessary to alter the intended meaning, of the passage material, so as to make it interpretable in terms of their own knowledge base. Still other Ss would consider parts of the passage to be beyond their comprehension and no further attempt would be made at understanding or retaining the information.

It was thus hypothesized that, in general, those Ss who reported no difficulties in understanding the passage would have the most accurate and comprehensive storage, which would result in superior retrieval. However, reported ease of understanding may not necessarily correlate with an accurate interpretation of the passage.

(5) Did you note down any important points?

It was predicted that note taking could facilitate learning and retention in the following ways:

(a) By helping ensure that the learner attends to the to-be-remembered information.

(b) In the process of reproducing information in note form the learner may well encode the material into a form that can be remembered more easily than the original version.

(c) The actual processing operations carried out by the individual as he takes notes, may bring about increased retention of the passage information.

(d) It is also conceivable that the visual and motor stimulus involved in note taking may itself facilitate

storage and later retrieval (Howe, 1974, P224).

It was thus hypothesized that in general, note taking would facilitate storage and retrieval of passage information. At the same time however, for those Ss not proficient at note taking, this could prove a very inefficient use of study time.

(6) What did you do to help you remember?

The purpose of this question was:

(a) to ascertain the degree of S awareness of what they did to help them understand and remember the passage material,

(b) to gain from Ss, without further prompting, the reported use of specific learning-memory strategies.

(7) Were there any parts of the passage which stand out in your mind? Why?

It was predicted that those parts of the passage which stood out in the S's mind at the time of storage would be those most readily recalled in the post-test. By reason of their standing out, these facts would have some salient attribute, by which they could be accurately stored and readily retrieved.

(8) Did you select parts you thought should be remembered and forget about other parts?

(If 'yes') - What were your reasons for selecting or forgetting about these points?

Through selectively attending to the major points in the passage Ss could reduce the amount of information which had to be processed. For those parts of the passage attended to there would likely be more accurate storage of a greater

number of features. These facts, at least, should then be readily recalled on the O.E. test (and on the M.C. test, if those facts selected for attention, were those referred to in the M.C. questions). As with question 3, this would result in superior scores on the O.E. test only so long as those Ss who were not selective, did not have time to understand and accurately store a greater number of facts.

(9) Would you have treated the passage in the same way if you were not going to be tested?

The purpose of this question was to ascertain whether pupils saw a need to do anything 'special' to help them remember information over time; and if so, what they in fact did. The premise was that those Ss who saw a need for the deliberate use of learning-memory strategies to aid future recall, (and did use these strategies), would achieve more extensive and accurate storage and thus perform better on the post-tests.

(10) What sort of test do you think I will give?

This question was to determine whether the pupils had any specific preconceptions of what form the post-test would take. It was hypothesized that the strategies used by Ss may have depended, in part, on the type of test Ss predicted.

(11) Did you ask yourself questions to see if you could remember the important points?

The purpose of this question was to determine whether self-testing was used. By testing themselves, according to their preconceptions of the demands of the predicted test, Ss could check on the current retrievability of the passage

material and direct their learning on the basis of these findings. Self questioning also provides practice in locating and retrieving the stored information. Thus it was predicted that the use of self-testing would result in superior retention on the O.E. and M.C. tests.

The advantages of self-testing would however be limited if the Ss only asked themselves questions concerning the material with which they were already familiar. Optimal use of self-testing requires that Ss extend this activity to material which, initially, they were unable to recall or on which they did not question themselves.

(12) Did you repeat any important words or sentences to yourself?

Researchers, such as Atkinson and Shiffrin, (1968), see repetition as important in the transfer of material from S.T.M. to L.T.M. Repetition may also provide a further chance for S to gain a full understanding of the material, to associate this new information with his/her established knowledge base and to store a greater number of attributes for the information.

For this reason it was hypothesized that, in general, those Ss who reported the use of repetition would perform better on the post-tests. It was also noted however that "With more existing knowledge about incoming information, there would be less tendency on the part of S to engage in rehearsal". (Kumar, 1971, P396)

(13) As you were reading the passage did any parts of it remind you of things you have done or seen?

This question is based on the premise that the meaningful processing of information necessary for learning and retention, involves the association of new information with that already in L.T.S. A written passage has meaning for S to the extent that he/she can associate the passage information with his/her established knowledge base; this being necessary for accurate, comprehensive storage. Thus it was hypothesized that those who reported the use of such associations would gain superior post-test scores.

(14,a) What do you imagine it would be like in an area that a hurricane or tornado was passing through?

It was hoped that through this indirect question, Ss would make some reference to the use of pictorial imagery. If no reference was made to the use of imagery when the above question was used, a more direct question, (14,b), was used.

(14,b) Did you think in terms of words or did you form pictures in your mind?

Various recent studies (Pavio, 1971; Kulhavy and Swenson, 1975; and Bower, 1972) suggest that retention is greatly facilitated if Ss use pictorial imagery during storage. Based on this evidence it was hypothesized that those Ss who reported the use of pictorial imagery when studying the passage, would show superior retention on the post-tests.

(15) Are there any other ways you know of helping you to remember things, which you didn't use here?

The purpose of this question was simply to determine whether there were strategies used by the pupils, which were not elicited by preceding questions, or alternatively, strategies not used on this occasion, but which Ss may use with other material or in other situations.

CHAPTER III

METHOD

I. SUBJECTS

All Ss in the major study were from six (of ten) Form I classes at Heaton Intermediate School. These classes were selected by the school's principal, on the basis of classes whose teacher, he thought, would willingly have his/her class participate in the study. Five of the selected classes had a cross section of pupils, one was a 'top-stream' class of selected high ability pupils. All pupils in these six classes participated in the study. When those pupils who were absent, either when the passage was presented or when the post-test was given, were eliminated, the group consisted of 165 Ss.

II. PROCEDURE

The procedure consisted of presenting a passage with instructions to study it, followed by interviews for selected Ss; a retention period of 4 weeks and 5 days; and a final post-test session. This is shown in Table I.

This procedure was followed on different days for each class. The day of presentation was determined largely by convenience for the class teacher. The day of post-testing was then determined by the need for an equivalent retention period for each class. An outline of the resulting schedule for presentation and post-testing can be seen in Table II.

TABLE I - An Outline of the Procedure Followed

1.	(a) Presentation of Passage	Passage presented and instructions given to class. 15 minutes study. Collection of passages and any notes taken.
	(b) Interview	Interview ('Full Data' group only).
2.	Retention Period	4 weeks and 5 days.
3.	Post-Testing	(a) Ss predict own retention (b) O.E. test (max. 20 min.) (c) M.C. test (12 min.)

TABLE II - Timing of Passage Presentation and Post-Testing

Room	Date - Presentation and Interview	Date - Post-Testing	Retention Period
A	2-7-75	4-8-75	33 days
B	9-7-75	11-8-75	33 days
C	11-7-75	13-8-75	33 days
D	14-7-75	15-8-75	32 days
E	16-7-75	18-8-75	33 days
F	18-7-75	20-8-75	33 days

III. DATA GATHERING

Data was gathered on age, sex, I.Q., and reading comprehension for all Ss. The I.Q. was obtained from the A.C.E.R. Intermediate D, as measured in November 1974. (Scores for this test are given as an I.Q. range; thus for ease of computation I.Q. was recorded as the mean of the range given.) Reading comprehension scores were obtained from the N.Z.C.E.R. Progressive Achievement Test (P.A.T.) for Reading Comprehension Part 5; administered in February 1975.

The total group (N = 165), for which this data was obtained, will be referred to as the 'all cases' group. (Reading comprehension scores for 3 Ss and I.Q. scores for 10 Ss were unavailable.)

For 121 Ss no further information was obtained. This group will be referred to as the 'part data' group.

From the all cases group a sample of 46 Ss was selected on the basis of P.A.T. Reading Comprehension scores. This group was selected as representative of the full range of the comprehension ability found in Form I at the school from which this sample was taken. This group was reduced to 44 Ss as a result of the absence of 2 Ss on the day of the post-test. This 'full data' group, were individually interviewed (see Appendix C.2.) immediately following the presentation and study of the passage. It is on the results obtained from the full data group, that the major findings of this study are based.

The distribution of variables, on which data was obtained, for the three groups, is reported in Table III.

As a result of initially incorrect P.A.T. scores being provided for one class, the full data group contained too many pupils in the lower reading comprehension range. As Table III shows, this resulted in the full data sample having a mean P.A.T. Reading Comprehension score (and I.Q. score) below that of the overall mean for all cases.

The proportion of males to females for the full data group was 26 : 18. The predominance of boys to girls was present at all levels, but most marked at the lower ability levels. It was however predicted that sex would not affect post-test performance. This prediction was supported by the low correlations being 0.04212 and 0.19912 for the O.E. and M.C. tests respectively.

TABLE III - Statistics for Subjects' Age, I.Q. and Reading Comprehension.

	Full Data	All Cases
Variable AGE	(N = 43)	(N = 164)
Mean	133.977	133.494
S.D.	5.143	4.700
Variance	26.451	22.092
Range	23.000	29.000
	124 - 147	123 - 152
Variable I.Q.	(N = 42)	(N = 155)
Mean	109.595	113.948
S.D.	12.915	12.068
Variance	166.783	145.647
Range	50.000	52.000
	85 - 135	83 - 135
Variable RDG. COMP. (Raw)	(N = 44)	(N = 162)
Mean	20.523	24.364
S.D.	8.649	7.225
Variance	74.813	52.196
Range	30.000	32.000
	8 - 38	8 - 40
Variable RDG. COMP. (Pcl.)	(N = 44)	(N = 162)
Mean	48.955	63.981
S.D.	29.896	24.608
Variance	893.765	605.571
Range	94.000	94.000
	5 - 99	5 - 99

IV. THE PASSAGE

The retention passage used in the major study was adapted from a passage entitled "Wind Movements: Dangerous and Otherwise" [++]. The original passage was adapted slightly and tried out with a sample of Form II pupils at Kirkwood Intermediate School. Most of these pupils read the passage without difficulty.

The passage was typed onto three pages and entitled "Dangerous Wind Movements". It was divided into two major sections sub-titled 'Tornadoes' and 'Hurricanes' respectively (see Appendix B.1.). The section sub-titled 'Tornadoes' dealt exclusively with tornadoes; that sub-titled 'Hurricanes' was for the major part concerned exclusively with hurricanes, but did make some comparisons between hurricanes and tornadoes. The passage consisted of 45 sentences. These were later numbered in order to identify parts of the passage mentioned in the interview and recalled in the post-test (see Appendix B.2.).

Presentation of Passage

Pupils were instructed to clear their desks of everything except a pen and a piece of paper. One copy of the passage(three sheets) was distributed face down to each pupil. The experimenter then gave the following instructions.

"I am doing some work at the university, on memory. I am trying to find out what you do to help you remember.

[++] In, Be A Better Reader, Foundations C, edited by Nila Banton Smith.

I will give you each a passage to read. In four weeks time I will return and give you a test to see how well you understood the passage and to see if you can still remember the important points.

Do not mark the sheets. You may make notes on another piece of paper if you wish. These notes will be taken in by me at the end of this period.

Do not turn over the passage until you are told to do so. You will have 15 minutes in which to read the passage and remember the important points.

I will then question some of you, to find out what things you did to help you remember.

Are there any questions?"

As there proved to be some misunderstanding as to whether or not pupils could keep their notes, with Room A; the fact that the experimenter would keep the notes following the initial learning period, was emphasized with the following classes.

The experimenter called out the time left to study after 5 minutes, 10 minutes and 14 minutes. When the 15 minute study period was up, the pupils were told to stop reading and turn the passage and any notes they had written, face down on the desk. Pupils' notes and the passages were then collected. Following which the class was handed back to the teacher to resume normal classroom activities.

V. THE INTERVIEW

Immediately following presentation of the passage, individual interviews were begun with the selected pupils, in another room. Following each interview, the S would return to the classroom and ask the next S to come for their interview. Pupils were interviewed in a random order, except for Rooms E and F where the two pupils with the lowest P.A.T. Reading Comprehension scores, were interviewed first.

The interviews were recorded on a cassette recorder (with the pupils' consent). The interviews took place with the pupil and experimenter sitting at opposite sides of a table. They began with a brief general discussion to establish rapport. As can be seen (Appendix C.2.) the early interview questions required more factual type answers than later questions. This allowed for the pupils to feel more at ease in the interview situation, before answering some of the more complex questions.

Questioning basically followed the Interview Schedule (Appendix C.2.), although at times it was extended or modified to meet the demands of a given interview. Consequently not all Ss were asked every question.

Scoring of Interviews

The recorded interviews were later transcribed and S's responses scored as follows.

Question 1 - How interesting did you find the passage?

0 - If at any time during the interview S stated that he/she definitely found all or part of the passage uninteresting.

1 - If S expressed a degree of interest in the passage (including replies such as: "it was all right", "I found it quite good") and at no stage reported disinterest.

Question 2 - Have you done any previous reading about hurricanes and tornadoes?

0 - If S reported no previous reading on the topic.

1 - If S reported incidentally reading about hurricanes, tornadoes or associated dangerous winds while reading for some other purpose (including reading the newspaper).

2 - If S reported reading a book, or part thereof, specifically concerned with hurricanes, tornadoes or associated dangerous winds.

Question 3 - Did you read all the passage more than once or just parts of it?

This question required scoring on two measures.

Firstly, each S was given a score corresponding to the stated number of times they had read the passage. Secondly:

0 - If S stated he/she had simply read the passage through one time after another; or read it straight through once and given up.

1 - If S stated that as well as reading the passage as a whole, he/she had selected specific parts of the passage for re-reading.

Question 4 - Did you understand the passage or did you have some difficulties?

0 - If S reported having had trouble understanding all or part of the passage, (except for specific words).

1 - If S reported understanding the passage with a minimum of difficulty (and this was not directly negated by

the interview as a whole).

Question 5 - Did you note down any important points?

0 - If no notes taken by S.

1 - If notes taken by S.

Question 6 - What did you do to help you remember?

Here responses were categorized according to strategy used (see Table V).

Question 7 - Were there any parts of the passage which stand out in your mind?

Responses here were recorded according to the 'number' of the sentence on which the 'stand-out fact' was based.

There were also five general ideas, which were frequently mentioned by Ss, but which did not correspond to any one sentence. These were numbered as follows:
91 - size; 92 - speed; 93 - formation; 94 - destruction; 95 - eye (see Appendix B.3.).

Question 8 - Did you select parts you thought should be remembered and forget about other parts?

0 - If S stated, or showed in answering this question, that he/she had simply tried to remember every fact in the passage.

1 - If S stated, or showed in answering this question, that he/she had been selective in what they tried to remember (and forget).

Question 9 - Would you have treated the passage in the same way if you were not going to be tested?

0 - If S reported doing nothing 'different' in the test situation, to that which they would have done in regular

classroom reading or research.

1 - If S reported approaching the passage differently in the test situation, to that which they would have done in regular classroom reading or research.

Question 10 - What sort of test do you think I will give?

Here responses were categorized according to the type of test predicted. Also:

0 - If S showed no specific preconception of the type of test he/she would receive.

1 - If S showed a definite preconception of the type of test he/she would receive.

Question 11 - Did you ask yourself questions to see if you could remember the important points?

0 - If S reported not having asked him/herself questions to see if he/she could remember the important points.

1 - If S reported having asked him/herself questions relating to the content of the passage, to see if he/she could remember the important points.

Question 12 - Did you repeat any important words or sentences to yourself?

0 - If S reported not having used such repetition.

1 - If S reported repeating words, facts or sentences over and over to him/herself.

Question 13 - As you were reading the passage did any parts of it remind you of things you have done or seen?

0 - If after being prompted with specific examples, S still reported not having made any associations.

1 - If S reported having associated parts of the passage with something he/she had done, heard or seen.

2 - If S reported associating parts of the passage with personal experience in a hurricane, tornado or associated dangerous wind.

Question 14 (a) - What do you imagine it would be like in an area that a hurricane or tornado was passing through?

No classification was made of replies to this question alone.

Question 14 (b) - Did you think in terms of words or did you form pictures in your mind?

On the basis of the replies to questions 14(a) and 14(b) S's responses were scored for both 'pictorial imagery' and 'verbal thought'.

Pictorial Imagery

0 - If when prompted, Ss still did not report the use of pictorial imagery.

1 - If Ss reported forming pictures in their mind, as a result of reading the passage.

Verbal Thought

0 - If S did not report 'thinking' in terms of words.

1 - If S reported thinking in terms of words (either exclusively or in conjunction with pictorial imagery).

Question 15 - Are there any other ways you know of helping you to remember things, which you didn't use here?

The replies to this question were such that classification was unnecessary.

VI. POST-TESTS

(1) Predicted Retention.

(a) The 'Test'. This consisted of a sheet (see Appendix D.1.) on which, by ticking the appropriate box, Ss indicated in general terms, the number of important points from the passage they thought they could remember.

(b) Administration. Pupils were first asked to fill in on the sheets, their name, room and school. The experimenter then read the instructions, with the pupils following on their own sheets. Pupils were then asked if they had any questions. Having answered the questions, the experimenter instructed the pupils to tick the appropriate box. Following which the completed sheets were collected.

(c) Scoring. S's predictions were given a rating of 0 - 4 as follows:

0 - 'None'

1 - 'A few'

2 - 'About half'

3 - 'Most'

4 - 'Nearly all'

(2) Open Ended (O.E.) Post-Test.

(a) The Test. This consisted of two sheets; one subtitled 'Tornadoes', the other 'Hurricanes' (see Appendix D.2. and D.3.). The instructions on these two sheets instructed pupils to note on the appropriate sheet, all they could remember about tornadoes and hurricanes.

(b) Administration. Pupils were given the test sheets, face down. When all the class had both sheets, they were

asked to turn them over and follow the instructions as the experimenter read them aloud. Pupils were told they had a maximum of 20 minutes to complete the test (approximately 10 minutes for each sheet).

Ss were then asked if they had any questions. These were answered and the Ss told to begin. Time was called every 5 minutes, and one minute before finishing time. When the 20 minute limit was up, Ss were instructed to stop writing and the answer sheets were collected.

(c) Scoring. Responses given on the O.E. test were scored on four measures as follows:

(i) Post I - O.E. Post-Test

One (1) mark was given for each basic idea (fact) recalled from the passage and recorded on the appropriate sheet. (Verbatim recall was not necessary).

Half (.5) a mark was given where there was partial recall of a basic idea, (e.g. S - "They can blow over 300 miles an hour"; Passage - "the horizontal winds may reach 300 miles per hour.").

Half (.5) a mark was given for the recall of the idea expressed in the title of the passage.

The passage was divided into 'facts' or 'basic ideas' (see Appendix B.2.) on the basis of sentences. Where more than one mark could be gained from a sentence, the facts are shown as 17 a), b), c) etc.

(ii) Post II - General Knowledge

One (1) mark was given for each specific, correct fact, stated by Ss on the appropriate sheet, which was not mentioned in the passage, (e.g. "Hurricanes can be named after girls").

Half (.5) a mark was given for each general statement, made by Ss on the appropriate sheet, which was not mentioned in the passage, (e.g. "You can tell by the sky when high winds are brewing up.").

(iii) Post III - Reversal

One (1) mark was given for each basic idea recalled by S, but attributed to the incorrect wind movement (i.e. not put on the appropriate sheet).

(iv) Post IV - False Statements

One (1) mark was given for each false statement (excluding mere reversal) made.

(3) Multiple Choice (M.C.) Post-Test.

(a) The Test. The M.C. Test consisted of eleven items, each with four choices (A, B, C, D). All were factual items, based on material in the passage. The position of the correct choice was determined by random assignment. Items (1) and (2) were deliberately easy questions, placed at the beginning of the test, so that any Ss who may have had difficulty with the passage, would begin with a feeling that the test was within their capabilities. The remaining nine items were ordered according to subject matter; tornadoes first, then hurricanes.

The test was presented on three pages (see Appendix D.4.); the first consisting of instructions, the second and third consisting of the test items.

A separate answer sheet was provided (see Appendix D.5.), on which Ss wrote the letter corresponding to what they saw as the appropriate choice for each item.

(b) Administration. Following collection of the O.E. test sheets, the answer sheets for the M.C. test were

distributed and the pupils instructed to fill out their name, room and school. The three page test booklet was handed out face down, while pupils completed the above task. Pupils were then instructed to turn over their test booklet and follow the instructions as they were read by the experimenter. Pupils were then asked if there were any questions; and when these had been answered, told to begin. Time was called after 5 and 10 minutes and on the later occasion it was suggested that pupils check their work. After 12 minutes had elapsed Ss were told to put down their pens. The answer sheets, followed by the booklets were then collected. This completed the data gathering for the major study.

(c) Scoring. A 'key' was used for marking, with Ss simply scoring one (1) mark for each correct choice.

CHAPTER IV

RESULTS

I. DESCRIPTIVE DATA

The exploratory nature of much of the present study, makes the descriptive data, in itself, an important part of the findings. This descriptive data provides an insight into a number of the important variables influencing learning and retention of written material in the classroom and Ss' knowledge of their own memory. In a number of cases it was possible to determine only what the pupils did, or did not do, in the learning-memory situation (as reported by themselves) and not why they did it or what effect they thought it would have on retention. This was due in part, to the nature of the interview, but also to the fact, that pupils were often, themselves, unsure of just what they had done, why they did it, and what effect they thought it would have on subsequent retrieval.

Findings on the various learning-memory variables for which the interviews provided sufficient data for reliable categorization (in terms of the reported 'presence' or 'absence' of these variables), are summarized in Table IV.

(1) Interest

It is unlikely that this measure of interest, by itself, provided a reliable measure of S's interest in the passage. Only three of the forty-four Ss admitted disinterest when interviewed. However experimenter observation, during Ss' study of the passage, suggested that

TABLE IV - Summary of Interview Response Distribution.

Strategy	Presence/Absence	Total N	N	%
Interest	No	44	3	6.82
	Yes		41	93.18
Previous Reading	No	44	24	54.55
	Incidental		9	20.45
	Purposeful		11	25.00
Number Times Read	1	42	16	38.10
	2		14	33.33
	3+		12	28.57
Selective Rdg.	All	44	12	27.27
	All + Parts		32	72.73
Understanding	No	44	20	45.45
	Yes		24	54.55
Notes	No	44	18	40.91
	Yes		26	50.09
Selective Learning	No	44	12	27.27
	Yes		32	72.73
Test Effect	No	44	18	40.91
	Yes		26	59.09
Self Test	No	43	28	65.12
	Yes		15	34.88
General Recall	No	44	32	72.73
	Yes		12	27.27
Repetition	No	43	7	16.28
	Yes		36	83.72
Assoc. Exper.	No	44	3	6.82
	Yes		39	88.64
	Ext.		2	4.55
Pictorial Imagery	No	44	7	15.91
	Yes		37	84.09
Verbal Thought	No	44	29	65.91
	Yes		15	34.09

the passage provided only limited interest for a greater number of Ss. (N.B. Responses such as "Aw, it was all right"; "I suppose it was O.K."; received a positive rating.)

Although Ss were not specifically asked the reason they found the passage interesting, a number of reasons were given. The most frequently reported reason (11 of the 44 Ss) was that they found the passage interesting because it presented them with new information; things they didn't previously know. A typical answer being: "Aw, well it's good because you can learn things about tornadoes and things, and hurricanes."

(2) Previous Reading.

Twenty of the forty-four Ss reported some degree of previous reading of material about hurricanes and/or tornadoes. For eleven this was purposeful, specific reading. For six of the eleven it involved previous reading at school, of an article covering much of the information in the experimental passage.

(3) Number of Times Read.

As can be seen (Table IV), the majority of Ss reported reading the passage one or two times. Only three Ss reported reading it more than three times. For two Ss the interview did not provide sufficient information to determine the number of times they had read the passage.

(4) Selective Reading.

Thirty-two Ss reported that they had been selective in their re-reading of the passage material.

(5) Understanding.

Twenty Ss reported having difficulties of some sort,

in understanding the passage. It should however be remembered that these included reports of some relatively minor and isolated problems.

(6) Notes.

Twenty-six Ss reported note taking. The majority of these Ss were however, not sure why note taking would be of advantage. Nine Ss made some general statement such as; "it helps you remember". A small minority saw the notes as forcing them to think about and come to some understanding of the passage material. As one pupil put it: "Well, it would probably make myself get the um, thing clearer 'cause I've got to write them down in English which I understand".

Two Ss who had not realized that they would not be able to keep their notes, reported that they took the notes with the intention of referring to them towards the end of the retention period. Others also suggested that they would have taken notes if they had been allowed to keep them for later reference.

(7) Selective Learning and Forgetting.

Although 72.73% of Ss reported that they selected parts they thought should be remembered and concentrated less on, or forgot about, other parts; very few could give a good reason for doing so or could express the criteria of selection they used. Five gave either no reason or an extremely vague and muddled criteria, for selection; 17 simply said that they concentrated on "the important" or "main" facts. Others said that they had concentrated on the information they thought most likely to come up in the test; or "parts that I didn't

really know much about". Only two Ss actually gave the information value of the material as their criterion, although this was probably implicit in the replies given by a number of other Ss.

An interesting reason was given by one very able pupil for not being selective. That was, she believed there were only important facts left in the passage, as it was itself a summary.

(8) Test Effect.

The figure of 59.09%, for those treating the passage differently in this 'test', than under normal classroom reading and research conditions, is lower than this author would have predicted. However various different activities used under test conditions were reported. Eight Ss reported taking notes (or more notes), seven that they had in some way gone back over selected parts of the passage, and four that they read it more times. (N.B. all of these strategies had already been discussed previously in the interview). The majority of Ss made vague reference to activities such as; taking more care, trying harder, or thinking more.

(9) Ideas on Test.

No meaningful means of categorization was found for this variable, using the available interview data. A number of interesting observations were however made. Only two Ss reported a definite preconception of what they thought the test would be like. One thought the questions would be orally presented by the experimenter with the pupils then having to write the answer. The second S gave a reply which

corresponded with the O.E. test subsequently given: "I think you might have asked us what we remembered out of it and some people might have said just the first couple of lines and others might have thought more and said quite a lot more of the important parts that were easier to remember". A third S also made a vague reference to an O.E. type test.

Eleven Ss made reference to the subject matter they thought the test would cover, without suggesting the nature of the test or what it would require of them. When the experimenter provided a prompt such as "Do you think you will have to write sentences, words or choose from a number of answers?", thirteen Ss made reference to a recognition, multiple choice type test, while nine made reference to answers requiring either words or sentences to be recalled.

(10) Self Testing.

Fifteen Ss reported asking themselves questions related to the passage to see if they could remember the important points. Although only a limited number of Ss were asked why they used self questioning, the responses were generally in terms of testing their state of retention. As one S said; "So I'm sure I know it". A number of Ss reported asking themselves questions they thought would cover material in the test.

(11) General Recall

In reply to the question on self-testing, nine Ss reported attempting to recall as much as they could about the passage (or parts of it) without actually asking themselves specific questions. Another three Ss reported setting

themselves a purpose for reading, in the form of a question, which they attempted to answer by reading the passage.

(12) Repetition.

The repetition of certain words or sentences was reportedly widely used by the Ss (83.72%). The majority of Ss gave one of two reasons for using this strategy. Seventeen Ss expressed some variation of: "to help remember it better"; "knock it into your brain"; so "it gets in your mind". Another reason explicitly stated by 7 Ss but implicit in other reports was the need to repeat the more difficult parts of the passage to gain an understanding. As one S put it; "some of the words that aren't very common, and things, I sometimes, I usually repeat those and see if I can get the full understanding". Or as another S stated, "I had to go back again and take it all in".

(13) Association with Experience.

As Table IV shows, nearly all Ss, (41 of 44), associated passage material with their own experience (established knowledge) to some extent. On initial questioning 22 Ss reported the use of association and 22 were either unsure whether they had used such a strategy, or gave a negative reply, (possibly because they thought 'experience' referred to first hand experience in a dangerous wind). However when prompted by a question such as; "It didn't remind you of anything you have read in a book or seen on T.V.?"; a further 19 Ss reported the passage evoking established knowledge. There were two Ss who were considered separately because, without prompting, they reported in some detail, during the interview, their direct personal experience in wind storms

(one in Africa and one in Canada).

A number of Ss differentiated between making the association while reading the passage as compared with making associations after reading the passage. One S for example reported that she attempted to avoid association until after reading the passage, in case it interfered with her interpretation of the passage. She had to admit however, that associations popped into her mind during reading, despite her efforts. Other reports also suggested that association was often not consciously attempted but just happened.

The majority of reported associations were with information (knowledge) gained from the news media, especially television.

(14) Pictorial Imagery.

Thirty-seven of the forty-four Ss reported, either with or without prompting, the use of pictorial imagery. There were however seven Ss who even after being specifically asked whether they had formed pictures in their mind, still did not mention the use of pictorial imagery. There were also others who although they used imagery, did so only to a limited extent, as they preferred to think verbally. As one S, whose father had taken colour slides of a hurricane, reported when interviewed:

S "..... they took shots of that and how the palm trees and everything like that were just about breaking."

E "Well did you think of these pictures that your father had taken when you were reading the passage. Did it remind you of the slides as you were reading

it through?"

S "Aw yes, um; most of the time I just thought of what he was talking about because he talked about it quite a lot."

Of those who did not initially report the use of pictorial imagery, the asking of a general question such as; "Did you think of some of the things that might happen as you were reading it (the passage)?"; resulted in seven Ss giving definitive reports of the use of pictorial imagery. Others gave replies in which the use of imagery may have been implicit, but which didn't provide sufficient information to determine whether or not pictorial imagery had in fact been used.

Of those Ss who were asked to elaborate further on the use and advantages of pictorial imagery, a number were unsure. The responses of other Ss suggested two possible sources of pictorial images. The first, is when a stored pictorial image is recalled as a result of an association being formed between the passage material and past experience. As one S who recalled a movie he had seen said; "It was just like showing a movie in my head; I could see it."

The second type of source suggested, is where the passage material provides the raw material used by the S to create his/her own picture of what he/she thinks the passage refers to. As another S said; ".... I think it's the story and it really describes it quite well, and you sort of get a picture of what it would be like or what you think it would be like".

(15) Verbal Thought.

When discussing pictorial imagery the Ss were asked whether they thought mainly in terms of pictures or words. To this question six Ss reported the use of verbal thought on its own and nine reported using it in conjunction with pictorial imagery.

(16) Replies to General Question of Strategies Used.

Replies to question 5, a general question asking pupils what strategies they used, to help them remember, were able to be categorized as follows:

(i) Repetition - any Ss who reported repeating all or part of the passage, to help them remember.

(ii) Think - any Ss who reported having thought about the passage, in general, to help them remember, e.g. "I thought about it a lot".

(iii) Selective - any Ss who reported being selective in what they tried to remember. (This does not include reported use of note taking.)

(iv) Self Testing - Ss who reported testing themselves to see what they could remember.

(v) No Idea - those Ss who in reply to question 5 did not report the use of any memory strategies.

Table V shows the number of Ss who reported using each of these strategies either alone or in conjunction with some other strategy. As the preceding question, question 4, dealt with note taking, question 5, often either explicitly or implicitly was concerned with strategies "other than note taking". Thus although five Ss reported

TABLE V - Categorization of Replies to General Question of Strategies Used.

Strategy	N
Repetition	12
Think	10
Selective	4
Self Test	2
No Idea	4
Others	8
Not Asked	9

the use of note taking, in reply to question 5, they were here included in the "others" category. (N.B. 26 Ss actually took notes.) The remaining three Ss in the others category reported rote learning, drawing diagrams, and 'sleeping on it over night', respectively.

Finally, there were nine Ss who were not asked this question.

(17) Recall of 'Stand-Out' Facts.

Table VI (a) shows the 'facts' from the passage, mentioned by Ss, as standing out in their mind. It shows the number reporting each fact as standing out and the mean recall for each of these facts on the O.E. test, by respective Ss.

For each general idea, (Facts 91-95), reported by Ss as standing out in their mind, the associated specific facts from the passage were determined and their mean recall calculated. These results are shown in Table VI (b).

TABLE VI - Mean Recall of 'Stand-Out' Facts.

(a)

'Stand-Out' Fact	N	Mean Recall
3	2	0.5
7	2	0.0
8	2	0.0
9	1	0.0
19	2	1.0
20	1	1.0
22	2	0.5
23	1	0.0
24	1	0.0
25	1	0.0
29	2	0.5
32	1	0.0
34	1	0.0
38	1	0.0

(b)

'Stand Out'	N	Assoc. Fact	Mean Recall
91	4	4	0.25
		23	0.00
		24	0.25
		32	0.00
92	6	7	0.17
		8	0.17
		35	0.00
		38	0.00
93	6	13	0.00
		14	0.00
		15	0.00
		16	0.17
		17	0.33
		18	0.00
		26	0.00
		27	0.17
94	2	19	0.00
		20	0.50
		21	0.00
		22	0.50
95	4	29	1.00
		30	0.50
		31	0.25
		32	0.00
		33	1.00
		34	0.50
		35	0.00
		36	0.75
		37	0.75

As these tables show, the facts which pupils reported as standing out in their minds when interviewed, were in many cases not recalled by the Ss in the O.E. test, 4 weeks and 5 days later. The exceptions were facts 19 and 20 and fact 95. For those Ss who mentioned facts 19 or 20 as 'standing out', there was 100 per cent recall. In the case of fact 95, all four pupils who made reference to the part of the passage about 'the eye' (in general) standing out, when interviewed, all recalled fact 29 plus at least one other specific fact about the eye, in the O.E. test.

II RETENTION STATISTICS

Table VII shows that the majority of Ss were able to recall only a limited number of facts on the O.E. test. The mean recall for the full data, interviewed sample being only 3.818 (range 1.000 - 11.00). As predicted, the prompts provided by the multiple choice questions resulted in 'superior' retention; the mean score on the M.C. test, for the full data group being 5.114 (range 2.000 - 9.000).

Also as expected the mean retention for all 165 cases was slightly higher (4.327, O.E. and 5.564 M.C.) than that of the full data, interviewed sample, owing to the lower P.A.T. and I.Q. scores of this later group.

III CORRELATIONAL RESULTS

(1) Facts Recalled / M.C. Correct.

The results shown in Table VIII, indicate that if a S recalled a fact in the O.E. test, which provided the basic information for the correct choice on the corresponding M.C.

TABLE VII - Retention Statistics for O.E. and M.C. Tests.

Variable - Post I (O.E.)		
	Full Data	All Cases
Mean	3.818	4.327
S.D.	2.793	2.883
Variance	7.803	8.310
S.E.	0.421	0.224
Skewness	0.714	1.049
Range	10.00	16.00
	1.000 - 11.00	0.000 - 16.00
Variable - Post M.C.		
	Full Data	All Cases
Mean	5.114	5.564
S.D.	1.895	1.832
Variance	3.591	3.357
S.E.	0.268	0.143
Skewness	0.105	0.038
Range	7.000	10.00
	2.000 - 9.000	1.000 - 11.00

item; then the S would identify the correct response for that item on the M.C. test (which followed directly after the O.E. test).

Results in Table VIII are based on the full data group (N = 44). They show the passage fact(s) on which each M.C. item was based (Associated Fact, O.E.) and the number recalling each of these facts, either 'correctly' or 'reversed', on the O.E. test. Finally, of those who recalled each fact respectively, on the O.E. test, the number getting the corresponding M.C. item correct, is given (No. M.C. Correct). M.C. item one (1), is not included in this

analysis because of its simplicity and general nature. Four Ss in fact recalled the associated passage fact (for item 1) on the O.E. test and all four chose the correct alternative on the M.C. item (as did 90.91% of Ss).

Of those Ss who recalled the information on which a given M.C. item was based, in the O.E. test, but did not answer correctly the corresponding M.C. item, the majority (7/10) were Ss who attributed the information to the incorrect wind movement (reversal). For example, the five Ss who incorrectly reported on the O.E. test, that a typhoon was (another name for) a tornado, also made this reversal in the M.C. test. Thus choosing, "(c) another name for a tornado" instead of the correct response "(b) another name for a hurricane", when answering question 8, "A typhoon is ..".

Only three Ss recalled facts on the appropriate sheet of the O.E. test, but did not recognise this information as the basis of the correct response to the corresponding M.C. item. Furthermore the responses of two of these three Ss, although correct and based on the same information as the M.C. item, were not in themselves specific enough to discriminate the correct choice on the M.C. item. For example, in the O.E. test one S wrote "... a layer of cold air pushing down on a layer of hot air .." (when referring to the formation of a tornado); which was correct, but not sufficient to make the differentiation between "cold moist air" and "cold dry air" required in selecting the correct M.C. alternative.

TABLE VIII - Relationship of Facts Recalled to M.C. Items Correct.

M.C. Item	Associated Fact (O.E.)	No. Recall Correct	O.E. Fact Reversed	No. M.C. 'Correct' Correct	Reversed
2	30	6	3	6	3
3	4	3	1	3	0
4	8	5	0	5	0
5	14	1	1	0	0
6	10	1	0	1	0
7	3	2	1	2	1
8	44	2	4	2	0
8	45	1	1	0	0
9	26	2	1	2	1
10	34	4	1	4	1
11	38	1	0	0	0
11	39	2	0	2	0

(2) I.Q., Comprehension / Post-Test, Predicted Recall.

As predicted, pupils post-test scores showed a significant ($P<.001$) correlation with both I.Q. and P.A.T. Reading Comprehension. As can be seen (Table IX), the correlations were higher for the interviewed (full data) group, though equally significant when all cases (full and part data) were considered.

Pupils' predicted recall also showed a moderately significant ($P<.05$) correlation with both I.Q. and reading comprehension. That is, the more 'able' Ss, in general, predicted higher recall.

TABLE IX - Correlation of Antecedent Measures with Post-Test Results.

		Full Data		All Cases	
I.Q.	Post O.E.	0.6358	s = .001	0.3970	s = .001
	Post M.C.	0.4846	s = .001	0.4059	s = .001
	Predicted	0.3165	s = .021	0.2517	s = .001
P.A.T.	Post O.E.	0.6980	s = .001	0.4552	s = .001
Comp. Raw.	Post M.C.	0.6801	s = .001	0.4719	s = .001
	Predicted	0.3419	s = .012	0.2288	s = .001
P.A.T.	Post O.E.	0.6881	s = .001	0.4219	s = .001
Comp. Pcl.	Post M.C.	0.6519	s = .001	0.4688	s = .001
	Predicted	0.2847	s = .031	0.1773	s = .012
Post O.E.	Post M.C.	0.5773	s = .001	0.3839	s = .001

(3) Correlation of Comprehension and I.Q. with Strategy Use. It seemed likely that the use of certain strategies would reflect the intelligence and especially the reading comprehension ability of the pupils. This was in part confirmed by the fact that six antecedent variables and strategies, showed significant ($P<.05$) correlation with either I.Q. and/or reading comprehension ability. Understanding, selective reading, test effect, and attempted general recall all showed a significant correlation with both I.Q. and reading comprehension. Previous reading correlated significantly with reading comprehension only and repetition had a relatively low correlation with reading comprehension percentile scores only (See Table X).

TABLE X - Correlation of Strategy Use With I.Q. and Reading Comprehension.

Q	Strategy	I.Q.	P.A.T.(Raw)	P.A.T.(Pcl.)
1	Interest	0.0637 +(0.344)	0.0587 (0.352)	0.0911 (0.278)
2	Previous Reading	0.1612 (0.154)	0.3468 (0.011)	0.3577 (0.009)
3	Number Times Read	-0.0112 (0.473	0.1045 (0.255)	0.1508 (0.170)
4	Selective Reading	0.3476 (0.012)	0.3179 (0.018)	0.3461 (0.011)
5	Understanding	0.4476 (0.001)	0.4455 (0.001)	0.5067 (0.001)
6	Notes	0.2057 (0.096)	0.1266 (0.207)	0.1692 (0.136)
7	Selective Attention	0.1328 (0.201)	0.1449 (0.174)	0.0923 (0.276)
8	Test Effect	0.4871 (0.001)	0.3860 (0.005)	0.4085 (0.003)
10	Self Questioning	0.1399 (0.191)	0.2027 (0.096)	0.2450 (0.057)
11	General Recall	0.3381 (0.014)	0.4400 (0.001)	0.4395 (0.001)
12	Repetition	0.0651 (0.343)	0.2233 (0.075)	0.2616 (0.045)
13	Association Experience	0.0520 (0.372)	0.1306 (0.199)	0.0822 (0.298)
15	Pictorial Imagery	0.2011 (0.101)	0.2446 (0.055)	0.2201 (0.076)
16	Verbal Thought	-0.0013 (0.497)	-0.0328 (0.416)	0.0092 (0.476)

+ significance

IV ANOVA RESULTS

(1) Predicted, Compared with Actual, Recall.

As Table XI shows, pupils predicted recall often did not correspond with their actual recall (the results of the ANOVA being non-significant even at the $<.10$ level). 54.55% of the Ss predicted they would be able to remember only 'A few' of the important points, while a further 25% predicted they would be able to remember 'About half' of the important points.

The results are complicated by the fact that there were two retention measures with which to compare predicted retention. Except for the two Ss predicting a retention of 'Most' of the important points, mean actual recall (O.E.) increased, for each successive predicted recall rating. This was also true when mean actual retention was taken as the mean of the O.E. and M.C. test scores. The scores then being 3.40, 4.23, 5.25, 3.75, and 6.35 respectively, on each rating. This expected trend was however not found when mean M.C. test scores alone were considered.

TABLE XI - Comparison of Predicted With Actual Recall.

Predicted Recall	Rating	Mean Actual Recall		N
		O.E.	M.C.	
None	0	1.800	5.000	5
A few	1	3.708	4.750	24
About half	2	4.955	5.545	11
Most	3	2.500	5.000	2
Nearly all	4	5.250	7.500	2
		df (4,39) F = 1.4115	df (4,39) F = 1.1825	

(2) Breakdown of Strategy Use - Criterion : Raw Scores.

In all cases, except one, the presence of antecedent conditions and strategy use, resulted in superior (though often not significant) mean retention on both measures (see Table XII). The exception being that those Ss who concentrated on verbal thought (rather than pictorial imagery) gained inferior O.E. test scores.

The results show considerable variance between O.E. and M.C., means and F ratios, on a number of measures. Overall the F ratios are not as high as predicted; with relatively few of the antecedent conditions or strategy uses resulting in significantly superior retention.

The presence and nature of previous reading, was the only variable which showed significantly superior performance on both retention measures (O.E. - $F = 7.1051$; df 2,43; $P<.005$. M.C. - $F = 3.6913$; df 2,43; $P<.05$). Those pupils who reported being selective in their reading of the passage performed significantly better on the O.E. test only ($F = 6.8926$; df 1,43; $P<.05$). Those Ss who reported the use of pictorial imagery also showed superior performance on the O.E. test ($F = 4.0820$; df 1,43; $P<.05$). Performance, for this measure, on the M.C. test being superior, but significant only at the $P<.10$ level.

As expected, those Ss who reported having no difficulty in understanding the passage, gained superior M.C. retention scores ($F = 4.9047$; df 1,43; $P<.05$). For these Ss recall on the O.E. test was also superior, but significant at only the $P<1.0$ level. Finally, those Ss who

TABLE XII - Strategy Use - Mean O.E. and M.C. Test Scores and F Ratios.

'Strategy'		Open Ended		Multi Choice		N
		Mean	F, Sig.(<.05)	Mean	F, Sig.(<.05)	
Interest	No	2.167	1.1287	4.667	0.1757	3
	Yes	3.939		5.146		41
Prev.Rdg.	No	2.563	7.1051	4.458	3.6913	24
	Inc.	4.889	(<.005)	5.667	(<.05)	9
	Purp.	5.682		6.091		11
No.Times Read	1	3.313	1.0267	4.813	0.2534	16
	2	3.286		5.071		14
	3+	4.583		5.333		12
Selec.Rdg.	No	2.125	6.8926	4.500	1.7606	12
	Yes	4.453	(<.05)	5.344		32
Underst.	No	2.975	3.5378	4.450	4.9047	20
	Yes	4.521		5.667	(<.05)	24
Notes	No	3.056	2.3412	4.722	1.3088	18
	Yes	4.346		5.385		26
Selec.Lrng.	No	2.833	2.1035	4.917	0.1748	12
	Yes	4.188		5.188		32
Test Effect	No	3.083	2.1651	4.889	0.4227	18
	Yes	4.327		5.269		26
Self Test	No	3.625	0.7554	4.893	0.8766	28
	Yes	4.400		5.467		15
Gen.Recall	No	3.547	1.1096	4.750	4.6908	32
	Yes	4.542		6.083	(<.05)	12
Repetition	No	2.714	1.5795	4.143	2.5262	7
	Yes	4.139		5.361		36
Assoc.Exper.	No	2.333	1.0356	4.333	0.7821	3
	Yes	3.821		5.103		39
	Ext.	6.000		6.500		2
Pict.Imag.	No	1.929	4.0820	4.000	3.0088	7
	Yes	4.176	(<.05)	5.324		37
Verb.Thought	No	4.138	1.1176	5.000	0.3009	29
	Yes	3.200		5.333		15

reported having attempted general recall during their study of the passage, gained superior M.C. test scores, ($F = 4.6908$; df 1,43; $P<.05$). In general, as stated earlier, the use of a number of other strategies resulted in superior mean performance on the retention tests, but did not show significant effects.

(3) Breakdown of Strategy Use - Criteria: General Knowledge, Reversal and False Statements.

When the O.E. tests were marked, not only was the number of facts correctly recalled, determined, but also the number of general knowledge facts recalled, the number of reversals made and the number of false statements were also determined. An ANOVA was performed, breaking down strategies on these three criterion variables, the results of which can be seen in Table XIII.

Only two strategies produced significant ($P<.05$) differences in recall of general knowledge information. These were repetition ($F = 4.4216$; df 1,43; $P<.05$) and pictorial imagery ($F = 4.6278$; df 1,43; $P<.05$). Using reversal (of hurricane and tornado attributes) as the criterion; the presence of previous reading ($F = 11.6469$; df 2,43; $P<.001$), test effect ($F = 11.8533$; df 1,43; $P<.005$) and association with experience ($F = 3.5619$; df 1,43; $P<.05$) all produced significant effects. When using the number of false statements as criterion, those Ss who took notes ($F = 4.2845$; df 1,43; $P<.05$), those who made associations with experience ($F = 3.8866$; df 1,43; $P<.05$) and those who used pictorial imagery ($F = 4.3327$; df 1,43; $P<.05$) all made significantly more false statements.

TABLE XIII - Strategy Use - Mean General Knowledge, Reversal and False Facts Scores and F Ratios.

Strategy		Post 2 Gen. Knowl.		Post 3 Reversal		Post 4 False Facts	
		Mean	F, Sig+	Mean	F, Sig	Mean	F, Sig
Interest	No	0.000	3.6162	1.000	0.0154	1.667	0.0153
	Yes	0.756		0.927		1.780	
Prev. Rdg.	No	0.667	0.1944	0.417	11.6469	1.542	0.8636
	Inc	0.833		1.333	(<.001)	1.778	
	Purp.	0.682		1.727		2.273	
Number Times Read	1	0.719	0.8280	0.938	0.1042	2.125	
	2	0.893		0.786		2.071	
	3+	0.542		0.917		1.000	
Selec.Rdg.	No	0.667	0.0494	0.750	0.5692	1.667	0.0783
	Yes	0.719		1.000		1.813	
Underst.	No	0.825	1.1384	0.800	0.6663	1.800	0.0115
	Yes	0.604		1.042		1.750	
Notes	No	0.611	0.5614	0.889	0.0579	1.222	4.2845
	Yes	0.769		0.962		2.154	(<.05)
Selec.Lng.	No	0.833	0.5780	0.667	1.2292	1.750	0.0036
	Yes	0.656		1.031		1.781	
Test Effect	No	0.528	2.0813	0.389	11.8533	1.500	0.9764
	Yes	0.827		1.308	(<.005)	1.962	
Self Test	No	0.768	0.3721	0.821	1.4805	1.786	0.0272
	Yes	0.633		1.200		1.867	
Gen.Recall	No	0.781	1.4893	0.844	0.9583	1.594	1.6449
	Yes	0.500		1.167		2.250	
Repetition	No	0.214	4.4216	0.571	1.2935	2.000	0.1869
	Yes	0.792	(<.05)	1.028		1.722	
Assoc.Exp.	No	0.000	2.3978	0.333	3.5619	1.333	3.8866
	Yes	0.731		0.897	(<.05)	1.667	(<.05)
	Ext	1.250		2.500		4.500	
Pict.Imag.	No	0.214	4.6278	0.857	0.0478	0.714	4.3327
	Yes	0.797	(<.05)	0.946		1.973	(<.05)
Verb.Thou.	No	0.845	3.8036	0.793	1.7556	1.793	0.0149
	Yes	0.433		1.200		1.733	

+P<.05

(4) Breakdown of Strategy Use Criterion : Residual Test Scores.

As well as raw scores on the O.E. and M.C. tests, residual scores (with sex, age, I.Q. and reading comprehension partialled out) were also computed. (A regression analysis summary is shown in Appendix E .)

An ANOVA on the antecedent measures and strategy use, using residual scores as the criterion, showed only one significant effect (see Table XIV). That was, previous reading about dangerous winds, resulted in significantly higher residual scores on the O.E. test, ($F = 4.8780$; df 2,39; $P<.05$).

Unexpectedly, the use of general recall resulted in lower O.E. test residual scores, than non-use; as did the test effect and to a very limited extent selective attention, on the M.C. test. These effects were however non-significant. As with the raw test scores, slightly lower test scores for those concentrating on verbal thought were found, when residual scores were used; but the effect was not significant.

V STRATEGIES AS DEPENDENT VARIABLE

The alternative to looking at the strategies used as the independent variable, as has been done with the results to date, is to make test performance the independent variable. This was done by forming a 'high' and a 'low' performance group for both the O.E. and M.C. tests (raw scores); then determining whether there were any noteable differences in the strategy use, of these two groups.

TABLE XIV - Strategy Use - Mean O.E. and M.C. Residual Scores and F Ratios.

Strategy		Residual O.E.		Residual M.C.		N
		Mean	F,Sig(<.05)	Mean	F,Sig(<.05)	
Interest	No	-0.475	0.4210	-0.385	0.1854	3
	Yes	0.298		-0.027		39
Prev.Rdg.	No	-0.501	4.8780	-0.225	0.9847	23
	Inc	0.672	(<.05)	-0.203		9
	Purp.	1.568		0.480		10
No. Times Read	1	0.306	0.8881	-0.015	0.0024	16
	2	-0.212		-0.119		14
	3+	0.444		-0.177		12
Selec.Rdg.	No	-0.476	2.3001	-0.285	0.4714	12
	Yes	0.530		0.040		30
Underst.	No	0.157	0.2411	-0.338	1.3633	18
	Yes	0.307		0.161		24
Notes	No	-0.075	0.7343	-0.284	0.8086	17
	Yes	0.459		0.105		25
Selec.Lrng.	No	-0.397	1.8013	0.011	0.0347	12
	Yes	0.499		-0.078		30
Test Effect	No	0.167	0.0413	0.229	1.1999	17
	Yes	0.294		-0.244		25
Self Test	No	0.286	0.1756	-0.263	2.2864	27
	Yes	0.539		0.416		14
Gen.Recall	No	0.344	0.2691	-0.092	0.0852	30
	Yes	-0.009		0.046		12
Repetition	No	-0.386	0.9717	-0.249	0.2043	7
	Yes	0.424		0.014		34
Assoc.Exp.	No	-0.937	1.0519	-0.043	0.6224	3
	Yes	0.262		0.111		37
	Ext	1.655		1.014		2
Pict.Imag.	No	-0.856	2.7101	-0.441	0.6635	7
	Yes	0.462		0.025		35
Verb.Thought	No	0.421	0.6819	-0.233	1.4560	28
	Yes	-0.114		0.308		14

The cut off point for the high group on both the O.E. and M.C. tests, was those Ss scoring 8 and above (five Ss for each test). For the low group, those getting a score of 0 or 1 on the O.E. test, or a score of 2 or 3 on the M.C. test, were the cut off points.

Table XV shows that the greatest differences in strategy use between the high and the low performers on the O.E. test were for previous reading (80% / 12.5%), selective reading (100% / 37.5%), and test effect (80% / 12.5%). There also being a considerable difference in reported understanding of the passage (80% / 37.5%). On the M.C. test the differences in extent of previous reading still remains (80% / 0.091%) and reported understanding this time shows a greater difference (100% / 36.36%).

The mean number of antecedent conditions and strategies used, was also greater for the high performance group, on both tests. Those scoring high on the O.E. test reported the use, on average, of 11.00 of these variables compared with 6.750 for the low group. When the M.C. test scores were considered the difference in the number of strategies used was slightly less, the average reported use, being 10.60 and 7.550 respectively.

VI ANALYSIS OF MULTIPLE CHOICE TEST

Table XVI shows the frequency with which each alternative was chosen, for each of the 11 M.C. test items. The correct alternative, (marked with an asterisk) and the

TABLE XV - Strategy Use of 'High' and 'Low' Performers.

	Raw Score O.E.		Raw Score M.C.	
	High	Low	High	Low
$\frac{N}{X}$	5 9.300	8 .7500	5 8.200	8 2.727
Strategy	% Use		% Use	
Interest	100.0	87.50	80.00	90.91
Previous Reading	80.00	12.50	80.00	9.091
No. Times Read	100.0	100.0	100.0	100.0
Selective Reading	100.0	37.50	60.00	54.55
Understanding	80.00	37.50	100.0	36.36
Notes	80.00	75.00	60.00	54.55
Selective Attention	80.00	50.00	80.00	72.73
Test Effect	80.00	12.50	60.00	45.45
Self Questioning	60.00	25.00	60.00	27.27
General Recall	40.00	12.50	40.00	0
Repetition	80.00	50.00	100.0	63.64
Association Experience	100.0	87.50	100.0	90.91
Pictorial Imagery	100.0	87.50	100.0	72.73
Verbal Thought	20.00	12.50	40.00	36.36
Mean number strategies used	11.00	6.750	10.60	7.550

percentage making this choice, are also shown. Finally, the correlation of the correct choice (on each item), with the overall M.C. test score is given.

As expected, owing to the deliberately easy nature of items 1 and 2, a high percentage of Ss made the correct choice on these items (90.91% and 88.64% respectively). This was also however, largely responsible for the low correlation of item 1 with M.C. total correct.

Items 5, 7, 8 and 9 proved relatively difficult questions and in each case, one or more of the false alternatives was chosen more often than the correct alternative. With item 5 the pupils obviously knew that it was cold air which prevented the warm air from rising; but whether this cold air was moist, dry, or in the form of a cold front, was a discrimination which many were unable to make correctly. In item 7 the large number (19) of Ss who falsely decided that; "the wind movement of a tornado is only counter clockwise", probably did so because this is the case with hurricanes; i.e., it was a case of reversal. Another example of reversal can be seen with item 8, where 13 Ss decided that; "A typhoon is another name for a tornado", when it is in fact another name for a hurricane. A further 14 Ss confused this with it being "a special type of hurricane". For question 9, it would seem that many Ss did not read the stem carefully enough. Thus having recalled about the violent nature of hurricanes, on land, 21 Ss then added to the stem "Hurricanes form over ..."; choice "(C) Tropical land masses", when the correct choice was in fact "(B) Tropical oceans".

TABLE XVI - Analysis of M.C. Test Responses.

Item	Alternative				%	r	Significance
	A	B	C	D	correct	M.C. total	
1	4	40*	0	0	90.91	.1036	.252
2	2	0	39*	3	88.64	.4422	.001
3	18*	8	10	8	40.91	.1963	.101
4	2	11	11	20*	45.45	.3344	.013
5	17	3	15	9*	20.45	.3903	.004
6	16*	7	13	8	36.36	.5090	.001
7	8	19	14*	3	31.82	.4795	.001
8	6	11*	13	14	25.00	.1891	.109
9	2	17*	21	4	38.64	.4081	.003
10	23*	5	4	12	52.27	.5194	.001
11	10	6	8	19*	44.19	.5594	.001

* correct alternative

CHAPTER V

DISCUSSION

The results of the present study do not provide an explanatory theory of learning and memory in school children, nor was it the purpose of this study to do so. As Pylyshyn (1973) points out; because we feel or think we are carrying out some learning-memory operation does not mean that this operation itself, is in fact responsible for the learning and retention which takes place. However the increased understanding provided by this study, of what Ss report that they do and think in a learning-memory situation, their understanding of their own memory processes and the influence of these two factors (either directly or indirectly) on retention, is important in its own right.

(1) Research Design.

The relatively large number of antecedent conditions and strategies considered in the present study meant that no one variable was studied in depth; consequently the picture provided by the results, is general in nature.

In an attempt to determine what strategies Ss used when faced with a learning-memory task involving written material and why they used these strategies, this study has ventured into the area of 'metamemory' (a S's verbalizable knowledge of his/her own memory processes). To investigate a S's knowledge and understanding of his/her own learning-memory processes however, poses a problem: how can such information be gained?

The method used here was the structured interview, which is simple and direct. There are however two problems with the knowledge obtained.

(a) Ss' answers may not be genuine. They may say what they think the experimenter wants to hear.

(b) They only report things they are conscious of, so that:

(i) there may be things they are not conscious of which are omitted in their reports.

(ii) what they are conscious of, may not be what is really happening.

In regards to the first problem, it would seem that in this study the large majority of Ss were genuine in their reports. However, it is not within the scope of this study to answer the second problem.

In future studies using the structured interview, more intensive and searching interviews, dealing with a limited number of variables, may well prove advantageous.

(2) <u>I.Q., Reading Comprehension, and Retention</u>.

The results show P.A.T. Reading Comprehension and I.Q. (A.C.E.R. Intermediate D) to have a greater correlation with retention scores than any of the strategies or antecedent variables studied. The moderately high correlation of these measures, with retention of written material over time, is not surprising. The A.C.E.R. intelligence test measures a number of general skills important in learning and retention and the P.A.T. test of reading comprehension, supposedly measures the skills which are basic to reading and understanding written material. When all Ss were considered

I.Q. and reading comprehension together, accounted for 22.22% of the test score variance on the O.E. test and 23.20% of the variance on the M.C. test. This still however, leaves much of the test score variance unaccounted for.

(3) Previous Reading and Association With Established Knowledge.

What part then did the strategies and antecedent conditions considered, play in the learning and retention of written material. Reports of previous reading, on the topic covered in the passage, consistently showed the strongest relationship with post-test scores. The effect being significant ($P<.05$) for both O.E. and M.C. raw test scores and the O.E. residual scores (see Tables XII and XIV). Also, when retention scores were considered as the independent variable, it was found that a far greater number of Ss who gained high O.E. and M.C. test scores, had done previous reading on the passage topic, than had Ss who gained low test scores, (80% and 12.5% respectively).

The importance of background knowledge of the topic studied, for retention, can also be seen in the fact that 93.18% of the interviewed Ss reported associating passage material with established knowledge. The association of passage material with established knowledge is widely acknowledged (Montague, 1972; Ausabel, 1968) to be an important factor in learning and memory tasks. Meaningful processing of to-be-remembered material requires S to acquire meaning for the passage, in terms of his/her established knowledge base. If S cannot achieve meaningful processing, it is very likely that he/she will simply not attempt to

remember the passage material at all, or if retention does take place, it will be the result of rote learning.

All but three Ss reported associating passage material with established knowledge (that is, things they had done, seen, heard or read about, and could still recall). The reports of several Ss suggested that the act of processing the material resulted in associations being made, whether Ss consciously attempted to do so or not (and in one case even when a deliberate attempt was made by S not to form associations while learning). However, owing to the fact that only three pupils did not report the use of association with experience, it is difficult to determine from the results of this study, just what effect the use of this strategy has on retention.

It would in fact seem unlikely that meaningful processing, such as that required for the comprehension and retention of meaningful written material, could take place without associations being made between passage material and established knowledge. The important question is; if pupils consciously attempted (or instructions required Ss) to make a greater number of meaningful associations, would their retention improve correspondingly.

(4) Reading, Interest, and Understanding.

In the present study, the length of the passage used in relation to the study time available, meant that the majority of Ss had time to read the passage several times. For example, one S of average reading ability read the passage five times, while two of the more able readers reported reading the passage six and eight times respectively.

The results suggest however that pupils realized that simply reading the passage over as many times as possible in the time available, is not a good strategy to use and they were thus selective in their re-reading. Further support for this hypothesis is provided by the fact that 12 of the 14 Ss with reading comprehension raw scores of 25 or more, reported being selective in their re-reading and read the passage on average only 2.36 times.

On the other hand it should also be noted that a number of Ss simply gave up 'learning' the passage after one or two readings, even though they had study time left and knew they were to be tested.

The results show that, up to reading the passage three times, on average the raw scores of Ss on the O.E. and M.C. tests increased with the number of times S read the passage. This trend did not continue for those who read the passage more than three times; probably because these Ss were simply reading the passage verbatim, at the expense of more efficient strategies.

Returning to the degree of interest shown in the passage by Ss; only three Ss admitted a definite disinterest, although experimenter observations showed that more than three Ss concentrated on the passage for as little as half the study time available. This however may not have been the result of disinterest in the passage material per se, but reflect, for less able readers a difficulty in reading and comprehending the passage and for others, a general lack of motivation to perform well in classroom tasks. An accurate measure of interest in the passage material would have

required both more extensive and intensive interviewing on this question and a more differentiated system of classification.

The need for more intensive interviewing on certain questions was also apparent on the question of understanding. Here the extent of interview questioning allowed for only a dichotomous classification. Despite this however, those reporting no difficulties in understanding the passage, performed significantly better on the O.E. ($P<.10$) and M.C. ($P .05$) tests.

(5) Selectivity - Reading, Learning, and Note Taking.

As has already been noted the majority (72.73%) of Ss were, after an initial reading, selective in their re-reading of the passage. Such selectivity it was hypothesized, reflects a more thoughtful and planned approach by Ss to the learning memory task. This would in turn allow for a more meaningful processing of selected passage material and finally superior recall. Mean test scores supported this hypothesis although the effect was significant ($P<.05$) only for the O.E. test.

Similarly, it was predicted that those Ss who reported being selective in what they attempted to learn, would gain superior scores, on the O.E. test at least. In the case of the M.C. test much would depend on whether the facts concentrated on were those relevant to the M.C. items. As predicted, the effect of selective learning was more pronounced on the O.E. test, although even here the effect was not significant. This lack of significance can in part be attributed to the fact that the passage contained very

little 'padding'. Nearly every sentence expressed a new and relevant fact. As one S put it; the passage was itself much like a summary. Furthermore the generous time allowance for studying the passage, may well have resulted in a number of pupils (especially the more able) who were not selective in their learning, still having time to adequately process and store more information than those who were selective.

It was expected that there would have been a moderate to high correlation between the use of selective reading and selective learning. This was in fact not the case, the correlation being $r = .0833$ ($s = 0.295$), which suggests that pupils see a definite distinction between the two strategies. It would seem feasible that some Ss were consciously selective in their learning, without being selective in their reading as such. As for those who reported being selective in their reading, but did not think this constituted selective learning; this can be explained by their interpretation of the question: "Did you select parts you thought should be remembered and forget about others?". These Ss maintained the view that no part of the passage was unimportant, and in saying that they were not selective in their learning, they meant that there were no parts of the passage which they thought could be ignored (forgotten).

Closely associated with these two aspects of selectivity is the question of note taking. As expected there was a moderate correlation between selective reading and note taking, $r = .4246$ ($s = .002$). There were however a number of Ss who did not see note taking as a form of selective learning. Again possibly because of their interpretation of the question on selective learning; that

is, their negative response to this question indicated that there were no parts of the passage which they had simply forgotten about.

As for the effect of note taking on retention, the results show a difference in mean scores in the expected direction (see Table XII), however the effect was not statistically significant. As predicted the effect of note taking on retention was more marked for the O.E. test than the M.C. test. Again probably because any notes taken could be recalled to advantage in the O.E. test, whereas only those notes which corresponded with the questions asked, would be useful in the M.C. test. The lack of significant effect for note taking may well be due to the fact that neither quality nor quantity of note taking was taken into account. Howe gives experimental evidence, which he says, "provides strong support for the suggestion that learning is influenced by individual differences in the kinds of note taking activities or strategies that learners adopt" (Howe, 1974, P226). Unless note taking results in S processing the passage material and summarizing the important points, it may well be a very ineffectual use of study time. For example, some Ss simply copied almost verbatim and with little discrimination, certain parts of the passage.

(6) Self Questioning.

When Ss were questioned on whether they asked themselves questions, to see if they could remember the important points, two basic strategies were reported: self testing and general recall (see marking schedule). Such strategies it appears allow Ss to monitor their state of recall readiness,

while practicing locating and retrieving the information. It is a means by which Ss can discriminate between those parts of the passage which have been adequately processed and are retrievable and those parts of the passage which require further processing. It may be seen as Ss giving themselves a trial test, in preparation for the test they know is to follow.

The limitations of such a strategy must however, also be kept in mind. To question oneself, requires some knowledge of the material on which the question is based; thus Ss are likely to ask themselves questions to which they know the answer. If this is the case, self questioning may provide only the advantages of practice in retrieval and a knowledge that certain parts of the passage are retrievable. To gain full advantage of such a strategy, Ss must then attempt to learn the material for which they did not think of questions and (as is the case for general recall) those facts from the passage which they were unable to recall. It is debatable whether in fact pupils do carry out this second and important stage of the strategy.

It would seem that although self testing involves the S asking himself a specific question, which he attempts to answer and general recall involves the S in recalling, in general, as many points from the passage as he can; they both serve a similar purpose. They do however differ in their effects on retention. As with the majority of variables studied, self testing showed a difference in mean scores on both post-tests, but not a significant effect. General recall on the other hand showed a significant ($P<.05$) effect,

but only for the M.C. test; a finding which is difficult to explain.

It perhaps reflects a lack of test sophistication that only 24 Ss reported the use of either self testing, or general recall (plus three who set themselves a purpose for reading); as such strategies seem to be an important, evaluative stage of learning and retention, in which the effectiveness of the learning-memory strategies used, can be tested and necessary changes be made before the retention test.

(7) Repetition.

Repetition is seen as an important variable in a number of models of memory (Atkinson and Shiffrin, 1968) because of the part it plays in maintaining information in S.T.M. and in transferring material to L.T.M. The results of this study suggest that pupils also see this as an important strategy, as 81.82% of the interviewed Ss reported its use. The mean retention scores for these Ss were higher on both the O.E. and M.C. tests than for non-users; the effect was however not significant. The importance of repetition for L.T.M. is probably due to the fact that it provides repeated opportunities for S to achieve meaningful processing of the passage material and thus allows for more accurate storage, which facilitates later retrieval. Rehearsal can thus be achieved by means other than mere verbatim repetition of passage material. Any strategy which requires repeated processing of the material would serve to maintain it in S.T.M. and may well play an even more important part than repetition, per se, in transfer to L.T.M.

(8) Pictorial Imagery.

There has been a considerable amount of research (and theorizing) which demonstrates that the use of pictorial imagery consistently facilitates recall (Pavio, 1971; Bower, 1972; Kulhavy and Swenson, 1975). The raw retention scores of Ss in this study support the above findings. Those Ss using pictorial imagery gained significantly superior scores on both the O.E. ($P<.05$) and M.C. ($.05<P<.01$) tests.

It cannot be presumed however that all Ss use pictorial imagery, even when the to-be-remembered material is conducive to its use. In this study, for example, even after considerable prompting, seven Ss still reported that they had not formed any pictorial images while studying the passage. Furthermore 15 Ss reported having concentrated on the use of verbal thought in preference to pictorial imagery. The mean score of these Ss on the O.E. test, was however inferior to the pictorial group.

Although it is the visual and verbal modalities which are concentrated on in this paper and indeed by most experimenters, they are in fact unlikely to be the only modalities used in learning and retention. Montague (1972) refers to Luria (1968), who describes a man who remembered material not only by 'picturing' the scene in which he learned it, but by other associations such as sound, smell, and feel. Pylyshyn (1973, P4) in a critique of mental imagery, states that present theories of pictorial imagery are unsatisfactory because no consideration is given to the possibility that cognition may be 'mediated' by something quite different from either pictures or words, different in fact from anything

that can be observed from within or without. Thus the dangers of concentrating on the pictorial and verbal modalities alone, must be kept in mind.

(9) Stand-Out Facts.

Only in a limited number of cases did Ss who reported that a certain fact stood out in their mind, when interviewed, recall this fact in the O.E. test. This result is difficult to explain, but may be partly explained, by the fact that learning and retention may well be achieved without presupposing recognition or recall. In the present study, Ss learned certain facts from the passage and readily recalled them when interviewed, shortly after (within two hours). However, after a retention period of 4 weeks and 5 days, Ss frequently did not recall these same facts on the O.E. test; possibly owing to the lack of cues provided by the test question. There probably was however storage of these facts in L.T.M. and with further cues to aid retrieval, recall may well have resulted.

Thus although this paper concentrates on the storage aspects of learning and memory, there is also a definite need for research into the processes of and strategies influencing retrieval.

(10) Predicted Retention.

A comparison of Ss' predicted retention as compared with their actual retention, suggests an inability on the part of Ss to predict their retention state (see Table XI). A closer look however suggests that this may well have been partly a product of the test situation and measuring instrument used. (See also Conclusions P98.)

After a 4 week and 5 day retention period it is not surprising that the majority of Ss thought that they would remember only a small percentage of the facts in the passage (which was in fact the case, as retention scores showed), but knew that there were some facts which they could remember. Thus 24 Ss indicated that they could remember 'A few' of the important facts. Just how many facts 'A few' is, being a matter of individual judgement. The Ss predicting more extreme retention were however, in general, less sound in their judgements, in terms of actual retention.

It is also necessary at this point to draw a distinction between the prediction of O.E. recall and M.C. recognition. While it seems feasible for a pupil to predict, in general terms, his/her retention, as measured by an O.E. test, several problems are posed in attempting to predict recognition on a M.C. test. In the case of the O.E. test the pupil can through self testing gain an estimate of the amount of passage material he/she can recall. However in the case of a M.C. test, S has no way of knowing just what questions will be asked or to what extent the item stem and alternatives will provide cues for recognition. The pupil has no way of knowing whether the material he/she has learned and retained will in fact be relevant to answering the questions asked. It would thus seem more meaningful to compare S's predicted retention with their O.E. rather than their M.C. test results.

(11) Strategy Use As Dependent Variable.

Considering strategy use as the dependent variable and test scores as the independent variable, on the whole, merely

confirmed the earlier findings. The only new effect to emerge, being that in general, those pupils who performed well on the O.E. test, saw a greater need for the conscious use of additional learning-memory strategies under test conditions (c.f. normal classroom reading and research), than did low performers (high - 80%; low - 25%). As with strategy use as the independent variable, the relationship between strategy use and test scores varied for the O.E. and M.C. tests (see Table XV).

It is however worthy of note that when raw scores on both the O.E. and M.C. tests were considered, those who gained the higher scores, on average, reported the 'use' of a greater number of antecedent variables and strategies, than the 'low' performance group.

(12) Strategy Use - General.

Although not as many strategies as initially expected, resulted in significantly superior retention, all strategies except for verbal thought (which is in many ways a restrictive strategy, as defined here), resulted in superior retention. This would suggest that there is no one, most effective strategy to use in a given learning-memory situation. What is important, is that by some means, S processes the material in such a way that it becomes meaningful for him/her and that this meaning is the same or very similar to that obtained from the passage by the person who constructs the retention test. Such meaningful processing allows for accurate storage and thus facilitates later retrieval.

Those Ss with high antecedent/strategy counts were

likely to be those with a greater background knowledge on which to base processing and/or those who used a greater variety of strategies to process the material. They were thus those Ss most likely to achieve meaningful processing and storage.

It is unlikely that any one strategy could provide a single S, let alone all Ss, with an effective means of meaningfully processing all the passage material. Different parts of the passage contain different types of information, which may be best dealt with by different methods of processing. The meaningfulness and comprehensibility of the passage material also differs for any given S. Furthermore what may prove a successful strategy for one S may not be so for another.

Another factor which must be kept in mind is that - "Since subject-controlled memory processes include any schemes, coding techniques, or mnemonics used by the subject in his effort to remember, their variety is virtually unlimited and classification becomes difficult" (Atkinson and Shiffrin, 1968, P106).

(13) Residual Scores.

As has been noted the significant effects of antecedent/ strategy use on raw retention scores were, with the exception of previous reading on the O.E. test, not present when residual test scores were used as the dependent variable. The results suggest that the antecedent conditions and strategies used by pupils, is an important variable for both retention, as measured by the O.E. and M.C. tests, in this study, and reading comprehension as measured by

the P.A.T. test.

Thus when reading comprehension was partialled out (along with I.Q., age and sex) to gain a residual score, much of the variance in test scores, resulting from strategy use, was also partialled out. Additional support is given to this conclusion by the fact that four of the five strategies which had a significant ($P<.05$) correlation with P.A.T. Reading Comprehension raw and percentile scores, also produced a significant ($P<.05$) effect on either the O.E. and/or M.C. test scores. These strategies being previous reading, selective reading, understanding and general recall. Four of the five strategies (previous reading, selective reading, understanding and test effect) also showed the greatest difference in use between high and low performers, when strategy use was considered as the dependent variable.

(14) General Knowledge, Reversal and False Facts.

As well as O.E. and M.C. test scores, general knowledge, reversal, and false facts scores were also computed and ANOVA performed on them. These results, which were not included in the original experimental design, are difficult to explain.

Why for example, should Ss who had done previous reading on the passage topic, make a significantly ($P<.001$) greater number of reversals on the O.E. test, than those who had not done such reading (see Table XIII). Perhaps it was because such Ss had a greater knowledge of dangerous winds and thus made a greater absolute number of statements in the O.E. test, but often their knowledge was not sufficient to determine whether the statements applied to hurricanes or

tornadoes. Some support for such a conclusion can be found in the fact that there was also a significant correlation between the number of reversals made and: I.Q. ($r = 0.4181$, $s = 0.003$); P.A.T. raw scores ($r = 0.4156$, $s = 0.003$); P.A.T. percentile scores ($r = 0.4240$, $s = 0.002$); O.E. test scores ($r = 0.4953$, $s = 0.001$); and M.C. test scores ($r = 0.4956$, $s = 0.001$). However why were the ANOVA results for reversals statistically significant ($P<.05$) for only three strategies: previous reading, test effect, and association with experience? Have these three strategies anything in common?

Similar questions and post hoc hypotheses could also be made up for the general knowledge and false facts results; however the meaning or significance of these results is outside the scope of this paper. A conceptual issue worthy of further consideration is raised here. That is, is it sufficient when measuring learning and retention to consider only the 'correct' responses made by S? Is it not just as important, to consider the false responses, the muddled responses, and those responses which intrude from Ss established knowledge, but which were not referred to in the tested material? The experimental situation places artificial boundaries on just what information S is given credit for, when retention is tested. It is usually restricted to information S can recognise or recall, from the material with which he/she was earlier presented. In 'real life' however, knowledge is gained from a variety of sources.

METAMEMORY

What then of metamemory, that is, the individual's potentially verbalizable knowledge and awareness concerning any aspects of information storage and retrieval (Kreutzer et al, 1975). This study shows that pupils at the Form I level do, with the exception of the very low ability child, have at least a basic understanding that some sort of internal processing takes place when one attempts to learn and remember material over a period of time. Their knowledge of just what does take place and how they could influence it, was however sketchy.

When questioned only two Ss reported a definite preconception of what they thought the test would be like. The interview reports did however suggest that Ss had a vague, almost subconscious idea of the sort of test which was to come. The vagueness of these ideas may well explain why nearly all Ss were either unable to express their ideas about the forthcoming test or did not see them as relevant, to answering this question.

The question relating to test effect also suggests a limited degree of test sophistication by Ss. Eighteen Ss said they did nothing in this test situation that they would not normally do in classroom reading and research. Furthermore those who did report the use of different strategies, reported only strategies already mentioned in the interview. No doubt, for some Ss a lack of either motivation, or appropriate knowledge and understanding of learning-memory task needs, resulted in them using only a limited number of learning-memory strategies. Others, no doubt used a number

of strategies, which because they were used with little thought or planning, they did not report.

A further expression of Ss' metamemory, was their replies to the question: "What did you do to help you remember?" Ss knew they must "memorize bits of it (the passage)", "knock it into my brain", and that this required "saying it over and over in my mind". Many saw a need to think about the passage: "I read it over one or two times and thought about it"; "Just thought of it". However, just what such activities involved and why they were necessary, this the majority of Ss were not really sure of. It would require comprehensive interviewing, following several learning-memory tasks, for Ss to unravel and verbalize to the experimenter, all that they had done to learn and remember the passage material and even then they would very likely be unsure of why they did it.

In many cases in the present study it seemed as though Ss, without knowing why, possibly from experience, intuitively performed certain operations on the to-be-remembered material. They often had no logical reason for doing so in terms of the nature of the passage material or the nature of the test expected.

It appears that Ss of this age do not think a great deal about what they are doing in the learning-memory situation. They use a method which may have gradually developed along with the increasing need for them to learn and retain information at school and elsewhere. The strategy they use may have been influenced by what had in the past been for them, an easy and reasonably effective method of learning

and retaining information, and also by Ss' conception of the demands of the task at hand. Unless the instructions require S to follow a specific plan of attack, it is more than likely that he will simply use a general study strategy which he/she sees as the easiest method of meeting the task demands, but which may not in fact be a very effective use of study time.

The findings of this study, in some ways, seem to refute the findings of Kreutzer et al (1975) who when referring to metamemory at the end of middle childhood conclude that: "More than the younger one, the older child may try to form and maintain a clear image of his future mnemonic goal and to try to find or create effective present means to its attainment. This sense of planfulness can be seen in retrieval as well as preparation for retrieval type problems" (P53). This statement may well be true as a statement of comparison of younger and older Ss, however the findings of the present study would suggest that the deliberate and planful choice, of an effective strategy for attaining the goals of learning and retention tasks, is not widely found among Form I children.

Kreutzer et al base their conclusions on findings from a structured interview study in which pupils were asked how they would solve hypothetical memory problems. Ss were asked about one specific type of retention situation at a time, which was in each case, intended to evoke responses about a particular learning-memory phenomena. However as Hagen points out in the commentary to Kreutzer et al's paper; " ... one cannot conclude that the children's views on how

they would solve memory tasks actually correlates with their performance in tasks that require mnemonic skills".

In contrast, in the present study, what were hopefully indirect questions, resulted in Ss reporting their knowledge and actual use of learning-memory strategies, following a learning-memory task. Even here however, it is likely that the interview situation resulted in deeper thought, by Ss, about the use and merits of various learning-memory strategies, than had taken place either prior to or during the study of the passage. That is, the interview situation used in both Kreutzer's and the present study, results in Ss being more thoughtful about the learning-memory situation than they otherwise would be.

Ss of this age do indeed have some understanding of their own memory processes and what influences them, but it is unlikely that they use this knowledge to any great extent when faced with a memory problem.

CONCLUSIONS

A primary purpose of this study was to determine the strategies Ss in fact use when learning and remembering meaningful written material in the classroom. The interviews did not bring to light any strategies further to those which had been reported by Ss in the pilot investigations and thus those on which the interview questions were based. It may well be that even the relatively indirect nature of the majority of questions used here, was not sufficient to deter Ss from reporting only information relating to the 'strategy' around which the question was based; thus greatly

reducing the chance of any other learning-memory strategies being reported. This however does not explain why other strategies were not reported in reply to the general question; "What did you do to help you remember?" The answer it would seem, is that given a retention task, pupils give little thought to which strategy(ies) would in fact best achieve their objectives. Pupils thus need considerable prompting if a report of any type of strategy use is to be gained. There is little doubt that pupils do use strategies other than those reported in this study; however those reported here, are those which Ss most readily verbalized.

As will by now be apparent, all the antecedent conditions and strategies considered in this study, except for verbal thought resulted in superior mean retention by users (as compared with non-users), although in a number of cases these effects were not statistically significant. Of all the antecedent/ strategies considered, previous reading produced the most consistently significant effect on retention.

In retrospect it was expecting a great deal, in hypothesizing that all antecedents and strategies studied, would result in significantly superior retention (as measured by the recall and recognition tests) for users. No one strategy is likely to be effective for all Ss or for all learning-memory situations involving written material. Strategy use depends on a multitude of variables. It depends on: characteristics of the learner, the nature and presentation of the to-be-remembered material, the nature and duration of the study and retention periods, the instructions

given, the perceived task demands, the type of test predicted, the perceived importance of remembering the material and S's intent to learn. All such factors may influence strategy use and its effectiveness.

In many cases a number of strategies may be equally effective in effecting retention. It does not matter so much, by what means encoding is achieved, rather that the necessary, meaningful processing does in fact take place.

It was also hypothesized that Ss would be able to predict, in general terms, their degree of retention of the to-be-remembered material, immediately before the retention test. On this issue it is difficult to draw any definitive conclusions from the study results. Except for those 24 Ss who predicted that they would be able to remember 'A few' of the important points from the passage, (which is in fact all any Ss recalled), Ss' predicted recall, seldom reflected their actual recall. This is however, in part, a result of the measuring instrument used. No S was able to recall even half the important points from the passage, thus three of the five levels of predicted retention, from which Ss had to choose, were in fact not applicable for any Ss. Furthermore just how many important points are 'A few', 'Most', and 'Nearly all', is open to individual interpretation. Such research needs a more appropriate, extensive and definitive scale on which Ss can rate their predicted retention.

Despite the limitations of the measuring instrument used here, the results and experimenter observations do suggest that pupils of 10-12 years of age, have considerable difficulty in predicting their retention state, after a

retention period of over 4 weeks.

As hypothesized the large majority of interviewed Ss could verbally convey a basic knowledge of their own learning memory processes and strategy use. They were aware of various factors which may influence retention; however this knowledge was used mainly incidentally. Few, if any Ss, thought in terms of how they could best use their knowledge of their own learning-memory processes to attain their retention objective. Unless prompted by specific questioning Ss' verbalizable knowledge was extremely limited, although their potentially verbalizable knowledge was much greater, as continued questioning showed. We must however be careful not to suppose that the extent of a pupil's potentially verbalizable knowledge, of his own learning-memory processes necessarily reflects knowledge which he uses in a planned way, when performing classroom retention tasks.

As is now accepted by numerous researchers (Anderson, 1970; Anderson and Hidde, 1971; Montague, 1972) the amount of learning which takes place is a function of the degree (depth) of processing (encoding) of the to-be-remembered material. It is thus essential for learning and retention that either S's intent to learn and/or the instructions given, result in S processing the material at such a level that it becomes meaningful for him/her in terms of his/her established knowledge base.

It is the task of the class teacher to ensure that his pupils do not simply "... 'read' without bringing to mind the meaning of the words they are speaking" (Anderson et al, 1971, P395). It must be realized that a pupil may often 'read'

written material, without semantic encoding. Thus the teacher who wishes his class to retain the written material which he presents to them or which they gather as a result of their own research, must ensure either that an intent to learn is developed by all pupils or more practically, that pupils undertake activities which require meaningful processing of the passage material.

The strategy(ies) which pupils are instructed to use will depend on pupil characteristics and the nature of the to-be-remembered material. One thing however is essential, that is, the task must require the pupils to process the material in such a way that it becomes meaningful for them, in terms of their established knowledge base.

CHAPTER VI

SUBSIDIARY STUDY: INTRODUCTION AND METHOD

INTRODUCTION

In conclusion to the major study it was stated, that the classroom teacher can ensure that his pupils retain the written information which he wishes them to remember, if he instructs them to undertake activities which result in meaningful processing, of that material. "The mature learner who intends to learn will usually complete the operations required to learn, but an intention to learn is unnecessary if the task itself requires full processing" (Anderson and Hidde, 1971, P528-529).

Such a view as this, raises a number of questions, in relation to this present study. Are pupils by Form I level 'mature learners'? Is their intent to learn under test conditions sufficient to produce 'full processing' of the to-be-remembered material? When an intent to learn is not present, will study instructions alone, result in pupils meaningfully processing the material, such that it facilitates retention? If so, what instructions (strategies) will produce such processing? These are questions on which this subsidiary study will throw some light.

It was the purpose of this study to determine whether instructing pupils to undertake activities which required them to meaningfully process the to-be-remembered written material, would produce comparable retention to encouraging

an intent to learn in pupils, by emphasizing the importance of a post-test which was to follow.

I HYPOTHESES

The following hypotheses were formulated.

1. Knowledge of a post-test will produce in Ss an intent to learn, which will result in them processing the to-be-remembered material at a level which will facilitate retention.

2. Instructions to use pictorial imagery will induce meaningful processing of the passage material by Ss and thus facilitate retention.

3. Instructions to compare passage material with established knowledge will induce meaningful processing of the passage material by Ss and thus facilitate retention.

4. Instructions to undertake tasks which are irrelevant to meaningful processing of the passage, will be detrimental to retention.

5. Instructions either to use pictorial imagery or to make comparisons will produce a level of retention comparable to informing Ss of a post-test.

6. Ss instructed to use pictorial imagery will have superior retention, to other Ss, on those items concerned with concrete objects and events which are presumably easier to form images of than more abstract and indefinite material.

7. Ss with superior reading comprehension-vocabulary levels will have superior retention (of the meaningful written material).

Pupils may process to-be-remembered material either

superficially or at a deeper, more meaningful level, in response to perceived or stated task demands (Anderson, 1970; Montague, 1972). The depth of processing in turn determining the amount of learning which takes place, the accuracy with which the information is stored and consequently the availability of the information for later retrieval.

Establishing in pupils an intent to remember and/or instructing them to undertake activities which require meaningful processing, are two means by which pupils may be induced to process to-be-remembered material at a depth, at which most effective learning and retention will take place. In contrast, instructions which require the pupils to undertake tasks which are irrelevant (or incidental) to meaningful processing are likely to result in pupils having neither the time, nor the intent, to carry out meaningful processing.

II STUDY VARIABLES

The variables involved in this study are as follows:

(1) Strategy Use (Independent).

All Ss were randomly assigned to one of four strategy groups.

(a) Incidental - This group was instructed to carry out three 'mechanical' identification and counting tasks (supposedly irrelevant to meaningful processing), involving the passage material.

(b) Logical Comparisons - This group was instructed to compare passage material with their established knowledge.

(c) Pictorial Imagery - This group was instructed to form pictorial images of the passage material.

(d) Knowledge of Test - This was the only group to be told of the forthcoming retention test. Ss were instructed to use any method they wished to learn and remember the passage material.

(2) Reading Level (Moderator).

Ss were considered in terms of one of four levels of reading comprehension - vocabulary, as measured by the N.Z.C.E.R. Progressive Achievement Tests (Form B, Part 5).

(3) Retention (Dependent).

Three measures of retention were used.

(a) Open-ended (O.E.) recall test.

(b) Multiple-choice (M.C.) recognition test.

(c) 'Pictorial' items on the M.C. recognition test (M.C. - Pictorial).

III OPERATIONAL RESTATEMENT OF HYPOTHESES

The hypotheses may be stated in operational terms, as follows.

1. Ss with knowledge of the forthcoming retention test and instructed to use any method of learning and remembering the passage which they wish, will gain significantly superior O.E. and M.C. test scores to Ss instructed to perform incidental tasks.

2. Ss instructed to use pictorial imagery will gain significantly superior O.E. and M.C. test scores to Ss instructed to perform incidental tasks.

3. Ss instructed to compare passage material (the city of Kano) with established knowledge (the city of Christchurch)

will gain significantly superior O.E. and M.C. test scores to Ss instructed to perform incidental tasks.

4. Ss instructed to perform tasks incidental to meaningful processing will gain significantly inferior O.E. and M.C. test scores to the other three strategy groups.

5. Ss instructed to use pictorial imagery and Ss instructed to make logical comparisons will gain O.E. and M.C. test scores which do not differ significantly from those of the knowledge of test group.

6. Ss instructed to use pictorial imagery will gain significantly superior M.C. - Pictorial scores to Ss in the other three strategy groups.

7. Within each strategy group mean O.E. and M.C. test scores will increase correspondingly with reading comprehension-vocabulary levels.

IV SIGNIFICANCE OF THE STUDY

It is hoped that this study will provide some insight into the factors which the classroom teacher must bear in mind, if his/her pupils are to retain the important points, from written material which they study. It is intended to show the importance of teacher instructions on learning and retention in the classroom. The study will provide information on the effectiveness of two specific learning-memory strategies, i.e. pictorial imagery and logical comparisons, in the retention of meaningful written material. It will also provide a comparison of the effectiveness of these two strategies as compared with simply instilling an intent to learn in Ss, while leaving them to use the strategy

of their choice. Finally, the degree of retention of the later Ss, will provide some insight into the effectiveness of pupils' use of, knowledge of their own learning-memory processes, to help effect retention.

METHOD

I SUBJECTS

The Ss consisted of all pupils in four (of nine) Form I classes at Shirley Intermediate School. These classes were selected for administrative reasons: the close proximity of the classes to each other and suitable timetabling. All classes had a cross section of pupils. When those pupils who were absent, either when the passage was presented or when the post-test was given, were discounted, there was a sample of 98 Ss. However an absence of data (reading level) for 3 Ss reduced the N for the ANOVA to 95 (41 boys and 54 girls).

II TASK

The passage (see Appendix G.1.) used for the retention task was an extract from an article entitled 'The Great Mud City of Kano', by R.B. Smith, in the New Wonder World Encyclopedia. The passage consisted of 702 words, was presented on 3 pages and had a Fry (1968) Readability Age level of 11 years.

III STRATEGY USE

Pupils were randomly assigned to one of four study (strategy) groups.

(1) Incidental.

This control group was instructed to perform three tasks, which were in fact incidental (irrelevant) to learning and remembering the passage material. The tasks were, counting and recording on the sheet provided, the number of times the word 'Kano' and the word 'the' appeared in the passage, and also the number of commas in the passage (see Appendix G.3.).

(2) Logical Comparisons.

This group was instructed to, through reading the passage, list all the ways in which they thought the city of Kano (passage material) differs from Christchurch (see Appendix G.4.).

(3) Pictorial Imagery.

This group was instructed to picture in their minds everything they read in the passage. They were also informed that they would later be given work that would depend on them having pictured in their minds all that the passage told about (see Appendix G.5.).

(4) Knowledge of Test.

This was the only group that was told that there would be a retention test 3 weeks later. They were also the only group told that their task was one of learning and retention. This group was instructed to use any method they wished, to

learn and remember the important points from the passage (see Appendix G.6.).

IV READING COMPREHENSION - VOCABULARY

The results of the major study for this paper showed pupils' reading comprehension ability to have a considerable effect on their retention of meaningful written material. Initially it was intended to control this variable through random assignment of Ss to study groups. This did in fact result in the four study groups initially having comparable mean reading levels. However when group numbers were reduced, as a result of absences, it was found that the mean reading level for the knowledge of test group was considerably higher than that for the other three groups (see Table XVII). Reading Level was thus introduced as a moderator variable.

It was hypothesized that like reading comprehension, reading vocabulary would also affect Ss' retention of written material. This fact, combined with the need for improving the reliability of single P.A.T. scores, resulted in a mean reading comprehension-vocabulary score (as measured by the N.Z.C.E.R. Progressive Achievement Tests) being computed for each S. However for three Ss neither the comprehension nor the vocabulary score was available; thus these Ss were not included in the data analysis. For a further three Ss only comprehension scores were available and for five Ss only vocabulary scores were available. After checking with the class teacher that these single scores were a valid measure of S's reading ability, they were used as the 'mean' reading level scores for these Ss.

TABLE XVII - Reading Comprehension - Vocabulary Statistics for Each Strategy Group.

	Incidental	Logical Comparisons	Pictorial Imagery	Knowledge of Test
n	+ 25/26	24/25	26/26	20/21
Mean	51.5400	52.8542	55.1538	62.5250
S.D.	24.1717	27.2139	22.8301	23.9789
Range	86.0000	86.0000	86.5000	90.0000
	4.5 - 90.5	6.0 - 92.0	9.5 - 96.0	9.0 - 99.0

+ n for which reading level data available / n participating in retention task.

All Ss for which there was data, were thus initially considered in terms of one of four P.A.T. reading groups, according to percentile means, as follows: 0-20 percentile; 20.5 - 45.0 percentile; 45.5 - 70.0 percentile; 70.5 - 99.0 percentile respectively.

As can be seen (see Tables XXII and XXIII) there were few pupils with reading comprehension - vocabulary mean percentile ratings of 20.5 or below, in the four unstreamed classes participating in this study. The cut off point for the low reading group was made at this level because after consideration of the interview information and retention test results for the major study, and discussion with the class teachers (for this study), it seemed that these would be the pupils who would have distinct problems with reading and comprehending the passage material. Support for this view can be found in the relatively low retention scores gained by this group, especially on the O.E. test (see Tables XXII and

XXIII). As a result of these factors the lowest ability reading group was excluded from the data analysis.

V RETENTION MEASURES

(1) Open Ended Test.

All Ss were presented with two sheets, one including instructions at the top, the other completely blank (see Appendix H.2.). Ss were instructed to note down on these two sheets, all they could remember about the mud city of Kano.

Scoring - Ss gained one (1) mark for each basic fact they noted on their test sheets. Each adjective, adverb; adjectival, adverbial or noun phrase; which added to the meaning of the basic fact (as expressed in the passage) gained one (1) further mark, e.g.

Kano is a city.	1 mark.
Kano is a market city.	2 marks.
Kano is a market city in Nigeria.	3 marks.
Kano is a market city in Northern Nigeria.	4 marks.

Verbatim recall was not necessary as long as the essential ideas from the passage were expressed.

(2) Multiple Choice Test.

The M.C. test consisted of 20 items, 19 factual and one inferential. For each item there was a stem and four choices (A, B, C, D). The position of the correct choice was determined by random assignment.

The test was presented on five pages (see Appendix H.3.); the first consisting of instructions, the remaining

four consisting of test items. A separate answer sheet, on which Ss entered the letter corresponding to what they saw as the appropriate choice for each item, was provided (see Appendix H.4.).

Following construction of the M.C. test, it was seen as desirable that the test items be divided into 'pictorial' and 'non-pictorial' items. Pictorial items (items: 4, 5, 6, 8, 9, 10, 12, 13, 17, 18, 19, 20) being those deemed, by the experimenter (in agreement with another rater), as items dealing with concrete items and events likely to have some familiarity for the pupil; for which the use of pictorial imagery would be extremely likely to facilitate retrieval. All other items being non-pictorial.

Scoring. Here a marking key was used and Ss received one (1) mark for each correct choice. Each S received two scores: a total score and a pictorial score.

VI PROCEDURE

In the afternoon, of the day preceding the presentation and study of the passage, all pupils in the four participating classes were told that their class had been selected to participate in research being carried out by the university and that this would require their class to be divided into four groups. Pupils were then informed of the room to which they would report at 9.00 a.m. the following morning.

Each of the four groups was taken by one of the teachers of the four participating classes (one being the experimenter). When settled in their appropriate rooms, Ss were told: "you have been chosen to take part in a study of

children's reading and studying habits being carried out by the university. It is important that you do the best you can and follow the instructions given, carefully ...".

Each teacher then proceded as laid down in the 'Teachers' Instructions' (see Appendix G.2.). The passages including instructions were handed out face down to each S. When all Ss had received their copy of the passage, they were told to follow the instructions (these varied for each group - see Appendix G.3. - G.6.) on the front page of the passage, while they were read aloud by the teacher.

Each group was given 20 minutes to study the passage (as instructed). Time was called after 5, 10, 15 and 20 minutes.

After 20 minutes had elapsed, Ss were told to put their pens down and turn over their passages. The passages were then collected and Ss returned to their own rooms.

No further mention was made of the study to Ss until the 2 week and 6 day retention period had elapsed. Immediately before testing was to take place, teachers of the participating pupils, told the Ss to go to their appropriate rooms. +

All four study groups (all Ss) received identical

+ Teachers participating in the study were briefed on exactly what was required of them, both the day before presentation and study of the passage, and the day before administration of the post-tests.

treatment and retention tests for this post-testing. The procedure followed can be seen in the teachers' instructions (see Appendix H.1.) and the pupil instructions accompanying the O.E. and M.C. tests (see Appendix H.2. and H.3.). In brief, Ss were told, "This is a test to see how much you can remember from the passage about the city of Kano which you read three weeks ago". The O.E. test sheets were then handed out face down, following which Ss were told to turn them over and follow the test instructions as they were read aloud by the teacher. The same procedure was followed for the M.C. test which was administered immediately after the O.E. test scripts had been collected. For both tests the time allowed was 20 minutes and time was called after 10, 15 and 20 minutes.

A summary of the procedure followed, can be found in Table XVIII.

TABLE XVIII - Summary of the Procedure for the Subsidiary Study.

Presentation of Passage	Passage presented and instructions given to all 4 strategy groups 20 min study Collect passage and any written work
Retention Period	2 weeks and 6 days
Post Tests	(a) O.E. test (20 min) (b) M.C. test (20 min)

VII DATA ANALYSIS

For an analysis of the results, a two-factor analysis of variance, for main, interaction and simple effects, with unequal cell frequencies, was performed on the data (according to Winer, 1971, Pp 445-449). As stated, owing to the small cell numbers and more importantly, the difficulty experienced by most of the low reading ability pupils (0 - 20 percentile), in reading and understanding the passage material, the lowest reading level was dropped from the ANOVA. Thus for the ANOVA a 4 (Study Strategies) by 3 (Reading Level) design was used (N = 84). Several planned comparisons (according to Winer, 1971, P215) were also performed using the 4 x 3 design.

The data analysis, as stated above, was carried out for both the O.E. recall and M.C. recognition test results. This was also carried out for the M.C. - Pictorial data, except for the simple effects of reading level.

CHAPTER VII

RESULTS AND DISCUSSION

I RESULTS

Main and Interaction Effects.

For all three retention measures (i.e. O.E., M.C. and M.C. - Pictorial) there were significant ($P<.01$) main effects for Strategy Use (A) and Reading Level (B) (see Tables XIX and XX). In no case was there a statistically significant interaction effect.

Hypothesis 1.

As hypothesized, knowledge of the post-test did result in Ss processing the to-be-remembered material at a level which facilitated retention. On both the O.E. and M.C. tests the mean retention for the knowledge of test group was superior to that of the other three strategy groups (see Tables XXII and XXIII). The difference was however statistically significant only when the comparison was with the incidental group ($P<.001$, for both the O.E. and M.C. tests; see Table XXVI).

Hypothesis 2.

As hypothesized, the instructions to use pictorial imagery did result in Ss processing the material in such a way as to facilitate retention. Planned comparisons (see Table XXVI) showed this strategy to produce significantly ($P<.001$) superior O.E. and M.C. test results to incidental processing.

For the third reading level (20.5 - 45.0 percentile) pictorial imagery proved a comparatively successful strategy; as this group gained superior O.E. test scores to those of equivalent reading ability in the other three strategy groups. A test for the simple effects of strategy use was however non-significant for this reading level, on the O.E. test (see Table XXV).

Although the fourth reading level are not included in the ANOVA, the comparatively very low mean M.C. and especially O.E. test scores, for the three pictorial imagery Ss at this level (see Tables XXII and XXIII) is worthy of note and in contrast with the above findings.

Hypothesis 3.

As hypothesized, those Ss instructed to compare the city of Kano (passage material) with the city of Christchurch (established knowledge), processed the material in such a way as to facilitate retention. The mean retention for this group being statistically superior ($P<.001$) to the incidental group on both the O.E. and M.C. tests (see Table XXVI).

It should be noted however that the third reading level (20.5 - 45.0 percentile) of the logical comparisons strategy group, gained somewhat inferior O.E. and M.C. test scores to either the pictorial imagery or knowledge of test groups of the same reading ability. However a test for the simple effects of strategy use at this reading level was significant ($P<.001$) only for the M.C. test. Similarly, on the O.E. test the second reading level (45.5 - 70.0 percentile) of the logical comparisons strategy group, gained inferior

TABLE XIX - ANOVA Summary Table for O.E. Test Scores.

Source Variance	S.S.	d.f.	M.S.	F	S.
Reading Level (A)	306.223	2	153.111	5.36909	<.01
Strategy Use (B)	920.648	3	306.883	10.7613	<.001
A x B	167.651	6	27.9418	0.97983	N.S.
Within Cell	2110.27	74	28.5172		

TABLE XX - ANOVA Summary Table for M.C. Test Scores.

Source Variance	S.S.	d.f.	M.S.	F	S.
Reading Level (A)	96.7954	2	48.3977	7.02771	<.005
Strategy Use (B)	172.361	3	57.4538	8.34272	<.001
A x B	47.9199	6	7.98664	1.15972	N.S.
Within Cell	509.616	74	6.88670		

TABLE XXI - ANOVA Summary Table for M.C. - Pictorial Test Scores.

Source Variance	S.S.	d.f.	M.S.	F	S.
Reading Level (A)	52.4183	2	26.2095	8.05016	<.001
Strategy Use (B)	73.6682	3	24.5561	7.54242	<.001
A x B	31.0046	6	5.16743	1.58718	N.S.
Within Cell	240.924	74	3.25573		

TABLE XXII - Breakdown of Mean O.E. Test Scores by Strategy and Reading Level.

	Incidental		Logical Comparisons		Pictorial Imagery		Knowledge of Test	
Reading Level	Mean	n	Mean	n	Mean	n	Mean	n
70.5 - 99.0	7.33333	6	17.5555	9	13.3750	8	19.1250	8
45.5 - 70.0	7.50000	7	13.5000	5	15.1111	9	15.9166	6
20.5 - 45.0	5.30000	10	9.35714	7	12.9166	6	11.4000	5
0.0 - 20.0	2.25000	2	3.50000	3	2.16666	3	6.0000	1
3 Rdg Levels								
Mean	6.50000		13.8571		13.9348		16.0789	
S.D.	3.79294		6.42873		5.92050		6.36017	
4 Rdg Levels								
Mean	6.16		12.5625		12.5769		15.5750	
S.D.	3.82350		6.97092		6.75824		6.58802	

TABLE XXIII - Breakdown of Mean M.C. Test Scores by Strategy and Reading Level.

	Incidental		Logical Comparisons		Pictorial Imagery		Knowledge of Test	
Reading Level	Mean	n	Mean	n	Mean	n	Mean	n
70.5 - 99.0	12.0000	6	14.5555	9	14.0000	8	14.2500	8
45.5 - 70.0	9.85714	7	12.8000	5	12.5555	9	12.5000	6
20.5 - 45.0	7.50000	10	10.5714	7	12.5000	6	13.8000	5
0.0 - 20.0	3.50000	2	10.0000	3	5.00000	3	10.0000	1
3 Rdg Levels								
Mean	9.39130		12.8095		13.0435		13.5789	
S.D.	3.15853		2.65742		2.80387		2.77520	
4 Rdg Levels								
Mean	8.92000		12.4583		12.1154		13.4000	
S.D.	3.43899		2.85869		3.74515		2.81724	

TABLE XXIV - Key to Simple Effects and Planned Comparisons Results.

A - Mean P.A.T. Reading Comprehension-Vocabulary Percentiles.	
a_1	- 70.5 - 99.0
a_2	- 45.5 - 70
a_3	- 20.5 - 45
B - Strategy Use	
b_1	- Incidental
b_2	- Logical Comparisons
b_3	- Pictorial Imagery
b_4	- Knowledge of Test

TABLE XXV - F Ratios and Significances for Simple Effects of Reading Level and Strategy Use. Criteria: O.E. and M.C. Test Scores.

	O.E.		M.C.	
Source Variance	F +	Sig.	F +	Sig.
SS_a for b_1	0.35919	N.S.	5.0220	P<.01
SS_a for b_2	4.02250	P .05	3.95188	P<.05
SS_a for b_3	0.32076	N.S.	0.71692	N.S.
SS_a for b_4	3.60529	P .05	0.81858	N.S.
SS_b for a_1	6.64342	P .001	1.32637	N.S.
SS_b for a_2	3.46794	P .05	1.90668	N.S.
SS_b for a_3	2.60973	N.S.	7.43054	P<.001

+ SS_a, d.f. = 2,74 SS_b, d.f. = 3,74

TABLE XXVI - F Ratios and Significances for Planned Comparisons of Reading Level and Strategy Use. Criteria: O.E. and M.C. Test Scores.

Comparison	O.E.		M.C.	
	F +	Sig.	F +	Sig.
b_1 with b_2, b_3, b_4	38.9271	P .001	34.3979	P<.001
b_1 with b_2	20.8354	P .001	18.6242	P<.001
b_1 with b_3	22.2910	P .001	22.2738	P<.001
b_1 with b_4	33.4777	P .001	26.4942	P .001
b_4 with b_2, b_3	2.21603	N.S.	0.81962	N.S.
a_1 with a_2	1.79753	N.S.	7.96730	P<.01
a_2 with a_3	7.64587	P .01	4.05017	P<.05

+ d.f. = 1,74.

scores to the pictorial imagery and knowledge of test groups, of the same reading ability. A test for simple effects showed a significant (P<.05) effect for both the O.E. and M.C. tests, at this reading level (see Table XXV).

Hypothesis 4.

As the results for Hypotheses 1 to 3 show, the incidental strategy group gained overall, significantly inferior test scores on both the O.E. and M.C. tests, to the other three strategy groups.

A study of the cell means (Tables XXII and XXIII) and the planned comparisons (Table XXVI) suggests that, especially on the M.C. test, the significant main effects for strategy use are largely a result of the comparatively low test scores of the incidental group.

Hypothesis 5.

The knowledge of test strategy group did on average gain superior O.E. and M.C. test scores to the pictorial imagery and logical comparisons strategy groups (see Tables XXII and XXIII). The difference was however minimal on the M.C. test and as hypothesized, on neither the O.E. nor the M.C. tests was the difference statistically significant (see Table XXVI).

Hypothesis 6.

The results do not support the hypothesis that Ss instructed to use pictorial imagery will have superior retention of the M.C. - Pictorial items, to the other strategy groups. The overall M.C. - Pictorial mean test score for the pictorial imagery group was marginally superior to that of the knowledge of test and logical comparisons strategy groups, but the difference was far from significant (see Table XXIX).

Only at the highest reading level (70.5 - 99.0 percentile), did the pictorial imagery group gain superior mean M.C. - Pictorial test scores to the other strategy groups; the test for simple effects of strategy use, at this reading level, was however not significant (see Table XXVIII). The test for simple effects of strategy use, using M.C. - Pictorial test scores, was significant only for the third reading level (20.5 - 45.0 percentile) and at this level the highest mean test score was gained by the knowledge of test group.

Hypothesis 7.

Although there was a significant ($P<.01$) main effect for reading level, for both the O.E. and M.C. tests, there

TABLE XXVII - Breakdown of Mean M.C. - Pictorial Test Scores by Strategy Use and Reading Level.

	Incidental		Logical Comparisons		Pictorial Imagery		Knowledge of Test	
Reading Level	Mean	n	Mean	n	Mean	n	Mean	n
70.5 - 99.0	7.33333	6	9.55555	9	9.62500	8	8.37500	8
45.5 - 70.0	6.28571	7	8.40000	5	8.33333	9	7.66666	6
20.5 - 45.0	4.80000	10	5.85714	7	8.00000	6	8.40000	5
0.0 - 20.0	1.50000	2	5.66666	3	2.66666	3	6.00000	1
3 Rdg Levels								
Mean	5.91304		8.04762		8.69565		8.15789	
S.D.	1.97514		2.26884		1.84477		1.97943	
4 Rdg Levels								
Mean	5.56000		7.75000		8.00000		8.05000	
S.D.	2.25610		2.38200		2.63818		1.98614	

TABLE XXVIII - Summary Table for Simple Effects of Strategy Use for M.C. - Pictorial Test Scores.

Source Variance	S.S.	d.f.	M.S.	F	S.
SS_b for a_1	24.3040	3	8.10138	2.48834	N.S.
SS_b for a_2	19.7220	3	6.57400	2.01921	N.S.
SS_b for a_3	60.6468	3	20.2156	6.20923	<.001
Within	240.924	74	3.25573		

TABLE XXIX - F Ratios and Significances for Planned Comparisons of Strategy Use. Criterion: M.C.-Pictorial Test Scores.

Comparison	F +	S
b_3 with b_2, b_4	1.57528	N.S.
b_3 with b_1	27.3498	<.001
b_3 with b_2	1.41586	N.S.
b_3 with b_4	0.92419	N.S.

+ d.f. = 1,74

were several exceptions to the stated hypothesis that within each strategy group mean O.E. and M.C. test scores will increase correspondingly with reading comprehension-vocabulary levels.

When mean test scores were considered there were three exceptions to the stated hypothesis (see Tables XXII and XXIII). Firstly, for the incidental strategy group, the top reading level (70.5 - 99.0 percentile) gained marginally inferior O.E. test scores to the second reading level (45.5 - 70.0 percentile); the cell means being 7.33333 and 7.50000 respectively. Secondly, for the pictorial imagery group, the top reading level gained inferior O.E. test scores to the second reading level; the cell means being 13.3750 and 15.1111 respectively. Finally, for the knowledge of test group, the second reading level had inferior M.C. test scores to the third reading level (20.5 - 45.0

percentile); the cell means being 12.5000 and 13.8000 respectively. It should be noted however that for none of the exceptions mentioned were there statistically significant simple effects for reading level (see Table XXV).

In fact, only for the logical comparisons group was there statistically significant simple effects for reading level, for both the O.E. and M.C. tests. For the incidental group strategy use was significant only for the M.C. test; for the pictorial imagery group there was no significant effect for strategy use for either the O.E. or M.C. tests; and for the knowledge of test group strategy use was significant only for the O.E. test (see Table XXV).

It is also worthy of note at this point that when reading level is considered, strategy use, for the M.C. test, has a significant effect for only the third reading level.

II DISCUSSION

(1) Meaningful Processing and the Intent to Remember.

The results gained, suggest that the classroom teacher can greatly facilitate his/her pupils' retention of written material, by ensuring that the pupils meaningfully process the given to-be-remembered material. This may be achieved by either (i) instilling in pupils an intent to learn and remember the material or (ii) instructing pupils to undertake activities which require them to meaningfully process the material.

In the present study knowledge of a forthcoming test (and thus, for the majority of pupils, an intent to learn

and remember) produced superior mean O.E. and M.C. retention scores, to instructing pupils to use a particular strategy. However as the results show, this difference was minimal for the M.C. test, and for both the O.E. and M.C. tests the difference in retention was not significant. The results suggest that knowledge of a forthcoming test is not a necessary prerequisite for meaningful processing and retention. Instructions to carry out processes which involve Ss in meaningful processing of the passage material, can be in themselves sufficient to effect retention.

The results show the effectiveness of instructing pupils to use separately one of two study strategies, namely logical comparisons and pictorial imagery. There must however be other, perhaps more effective, strategies which pupils could be instructed to use. Also, instructions to use a combination of strategies may well produce superior retention to instructing pupils to use any one strategy in isolation. Similarly, processing instructions plus a knowledge of a post-test may well produce superior retention to either method in isolation. Furthermore can we talk generally about instructing pupils to use certain strategies or combinations of strategies. Obviously different learning-memory strategies result in Ss processing the material in different ways and to varying degrees. Even when Ss are instructed to use the same strategy, the actual processes they perform and the degree of processing, will vary from S to S.

It should be noted that the discussion to date presupposes that the pupil has the ability to read and under-

stand the given written material, which in a classroom situation is frequently not the case for all pupils. It was for this very reason that the lowest reading level (0 - 20.0 percentile) was dropped from the analysis of results in the present study.

(2) Metamemory.

The fact that the knowledge of test group had overall superior retention to the other strategy groups, even though not significantly so, suggests that Form I pupils do at least have a basic knowledge and understanding of their own learning-memory processes. Their knowledge and understanding was sufficient for them to devise for themselves, suitable learning-memory strategies; which proved at least as effective as the experimenter imposed strategies. It may be that these pupils also at times used pictorial imagery and logical comparisons, in conjunction with other strategies which suited their particular needs and knowledge. They may well have found that different parts of the passage were, for them, conducive to different types of processing and selected their strategies accordingly. The point to be made in respect to metamemory, is that the majority of these Form I pupils (able to read and understand the passage) did through their own knowledge devise learning-memory strategies which facilitated retention.

(3) Reading Ability and Strategy Use.

Pupils' reading ability is a factor which must be taken into account when considering pupils' learning and retention of written material. The ANOVA results support the view that in general a pupil's ability to learn and remember

written material, is in part, determined by his/her reading comprehension and vocabulary level. As the results show however, there were within strategy groups, exceptions to the general trend. Even considering the fact that the simple effects for reading level, within the strategy groups concerned, were not significant, it is still difficult to explain these exceptions in terms of the available data. There seems to be no reason why pupils of superior reading ability should have inferior retention of information presented in a written form, to those pupils of lesser reading ability, when pupils at both levels were in the same treatment group.

Also, even though there were no significant interaction effects, there is some suggestion that the effect of pupils' reading levels on retention, may differ for each strategy. This can be seen by comparing the mean retention of the logical comparisons, pictorial imagery, and knowledge of test groups, at various reading levels, on the O.E. and M.C. tests. For example on the O.E. test, the top reading level of the pictorial imagery group gained a comparatively low mean test score, while the knowledge of test group at the same level gained a comparatively high mean test score (see Table XXII). Also on the O.E. test, at the second reading level, the mean test score for the logical comparisons group was considerably lower than that of the pictorial imagery and knowledge of test groups. Similarly for the M.C. test, the third reading level of the logical comparisons group gained a comparatively low mean test score. In each of the above three cases, tests for simple effects of strategy use were significant ($P<.05$) for the test and reading level stated.

It may be that relatively, some strategies are better than others for pupils of a given reading level. The present study does however not provide sufficient information to confirm such a prediction.

The mean cell scores (see Tables XXII and XXIII) and the F ratios for the tests of simple effects of strategy use at each reading level (see Table XXV) also suggest that the effect of strategy use is more marked and more consistent for the O.E. than the M.C. test. This again raises the question of the differences in retrieval processes, required for O.E. and M.C. tests. This is a question which will be considered further in the following chapter.

(4) Pictorial Items and Pictorial Imagery.

The results did not support the hypothesis that those Ss who were instructed to use pictorial imagery would have significantly superior retention of items deemed, by the experimenter (and another rater), to be conducive to pictorial processing. These findings are difficult to explain. Why would pupils instructed to use pictorial imagery not gain superior retention, of items conducive to this form of processing, to other strategy groups? It may be that some pupils not instructed to use pictorial imagery, did nevertheless perform such processing and not all those instructed to use pictorial imagery in fact did so. Perhaps those items which intuitively appear to be conducive to pictorial processing, are in fact no more so than other items. Or as Pylyshyn (1973) points out, just because we 'see' pictures in our mind does not mean that this is an explanation of the processes actually taking place.

A further possible explanation is that the nature of those items rated as pictorial may have in fact meant that they were also conducive to other forms of meaningful processing (whereas the information content of a number of the non-pictorial items was such that pupils would likely learn it by a rote method).

(5) Ensuring Meaningful Processing in the Classroom.

The consistently inferior test scores gained by the incidental group in this study, further supports the view that if pupils are to learn and remember information from written material they must, either as a result of their own intentions or as a result of instructions given, meaningfully process the to-be-remembered material. As Anderson (1970) points out, pupils tend to follow the law of least effort. Thus if pupils are not instructed to process material in a meaningful way and do not know they are going to be tested, it is unlikely that they will process the material given them, in any great depth. In the present study, the incidental group pupils were not only uninformed of the need for meaningful processing, but also instructed to perform tasks incidental to these ends. Tasks which undoubtedly occupied a considerable amount of their study time.

It is thus not surprising that this group gained significantly inferior scores to the other strategy groups, especially on the O.E. test. It should be noted however, that especially the more able readers, were with the aid of the cues provided, able to make the correct choice on a relatively large number of the M.C. items.

The results point to a need for teachers to be more

careful in the instructions they issue to their pupils. Teachers must be aware of the fact that the instructions they give may greatly influence the study method pupils use and consequently pupils' learning and retention of the information they are studying. The incidental group in this study may be an extreme case, however in perhaps less obvious ways teachers, through the instructions they give, may direct their pupils' attention and activities away from the intended study objectives. Conversely instructions may also be used to focus pupils' attention on a method of study which is most likely to achieve the intended objectives.

It is in many cases not practical, nor desirable, for a teacher to establish an intent to learn and remember in his pupils through the knowledge of a test. Furthermore, knowledge of a forthcoming test is unlikely to produce an intent to learn and remember in all pupils. The teacher is thus left with the difficult task of attempting to determine just which pupils have developed an intent to learn and remember, and to what extent. This then is one advantage of instructing pupils to perform tasks which are known to facilitate learning and memory. Such tasks can be made to require overt written or verbal responses and thus a check be made on the depth of processing taking place. The effectiveness of such instructions could no doubt be increased further, if an intent to learn and remember was also developed in the pupils (perhaps by making them interested in, and aware of the importance of, the work they are doing).

One problem however still remains. What are the 'best' strategies to instruct pupils to use? This study has

shown that instructing pupils to make logical comparisons and to form pictorial images can facilitate retention of meaningful written material. There are no doubt, other just as effective strategies which pupils could be instructed to use.

There is thus a need to look even closer at just what pupils in fact do when instructed to use a certain learning memory strategy. Also, does what they do and the effect on learning and memory differ for different pupils and for different materials? It may be that the actual means by which processing is achieved is not of major importance. Perhaps the major factor is that meaningful processing, in sufficient depth to meet the task demands, is in fact carried out.

An attempt will be made in the following chapter to draw some conclusions from the findings of the major and subsidiary studies, but one thing is certain, there is still a great need for further research in this field.

CHAPTER VII

CONCLUSIONS

I PUPILS' KNOWLEDGE OF LEARNING-MEMORY PROCESSES

The results of this research reinforce the view that the pupil is very much an active agent in his/her own learning and retention. The activities pupils engage in when faced with a retention task, play a large part in determining the accuracy and extent of their learning and retention. It is thus important to have some knowledge of, the pupils' knowledge and understanding of their own learning-memory processes, and the way in which the pupils' knowledge influences the activities they engage in when attempting to learn and remember.

It would seem that Form I pupils do have some understanding of their own learning-memory processes. The results of the subsidiary study show that pupils of this age are able to devise and put into practice learning-memory strategies, which produce comparable retention to experimenter imposed strategies. However even though many of the Form I pupils in this study were aware of certain strategies and other factors which may influence learning and retention, only in a limited number of cases was there any real understanding of why such factors influence retention. Furthermore, although pupils by the Form I level have at least a basic knowledge of their own learning-memory processes, it would seem that they often lack the motivation to use the information at their disposal. Pupils at this age seldom make a deliberate and planful choice

(based on a knowledge of their own learning-memory processes) of the most effective strategy, for attaining the goals of the particular learning-memory task with which they are confronted. They know that in general there are certain things you must do if you want to remember written material and these operations they carry out to the extent they think necessary to meet the perceived (or stated) task demands.

This then raises the question of whether we can teach pupils to learn and retain written information. It follows that if the activities (strategies) that pupils engage in, when presented with to-be-remembered material, are crucial in determining what pupils will learn and remember (Anderson, 1970, P349) and if teacher (experimenter) instructions can greatly influence both pupils' intent to learn and the strategies they use, then the teacher has indirectly, considerable influence over the success of the pupils' learning and retention. By ensuring (through discussion and example) that pupils understand the important factors involved in learning and retention, and by ensuring that pupils have at their disposal a selection of effective strategies for carrying out the necessary processing, teachers can in effect teach their pupils how to learn and remember.

II LEARNING, MEMORY, AND TEACHING RETENTION

If pupils can be taught to learn and remember written information, what strategies and what important factors involved in learning and memory should they be taught? Firstly, both teachers and pupils should be aware that the

processing of to-be-remembered written material may be carried out at several levels (Anderson, 1970; Anderson et al 1971; Montague, 1972). They should be aware that people can, and often do, 'read' without bringing to mind the meaning of the words; and that at this level neither learning nor retention is likely to take place. They must understand that what is required for effective learning and retention of written material is semantic encoding (processing). The learner must bring to mind meaningful representations of the words he/she reads. He/she must provide meaning for the words in terms of his/her established knowledge base.

Although from the results of the major (and subsidiary) study it was not possible to draw any definitive conclusions about the effect of pupils' conscious use of association with experience (41 of the 44 Ss reported using this strategy), it would seem that some form of association (possibly automatic or unconscious) is the basis of all meaningful processing. The processing of meaningful written material involves the reader in providing meaning for the written words in terms of what he/she already knows. New material is made to fit the reader's conception of the world and in doing so may also result in changes in his/her 'beliefs'. It should be noted however that the meaning the reader gives to the written word may differ from that intended by the author (and test constructor). If pupils (and teachers) could be made aware of the effect the associations which they make have on the storage of written information, then they may think more about the suitability and accuracy of the associations which they make and thus achieve more accurate storage and appropriate

retrieval.

A knowledge and understanding of the need for meaningful processing, and of strategies to achieve it, are however not sufficient to bring about learning and retention unless the pupil also (a) is able to read the written material with understanding and (b) has an intent to learn that material.

It is well outside the scope of this paper to deliberate on the teaching of reading. Thus the suggestions made and conclusions drawn, in large, presume the ability to read the to-be-remembered material with at least moderate comprehension. It is however worth noting observations made of the low ability readers' approach to learning-memory situations, involving meaningful written material. In both the major and subsidiary studies there were pupils who were unable to read the passage with more than minimal comprehension. Some such pupils were able to gain a general idea of the topic covered in the passage but had great difficulty comprehending the specific facts and ideas. The difficulty encountered by a number of these pupils in attempting comprehension of the passage, was such that they did not even attempt to understand some of the material, but rejected it as being beyond their comprehension. Another approach, possibly used by a number of the low ability pupils, was reported by one very low ability pupil in the major study. She treated the task as one of word identification. She attempted to 'read' (recognise) each word in turn but was not concerned with comprehension. These findings emphasize that both teachers and researchers must be constantly aware of the fact that the use of written material, within the reading and comprehension

ability of the majority of pupils in a given class, will on its own, be virtually meaningless for a small minority of these pupils.

The statement made on the need for an intent to learn does need some qualification. As has been stated, an intent to learn and remember, as such, is not essential for learning and retention if the activities the pupils are instructed to engage in (and do in fact perform) do themselves involve pupils in meaningful processing of the passage material (Anderson and Hidde, 1971). It should be noted however that in such cases it is still the pupil who determines to what extent he/she will follow the instructions given. Thus although an intent to learn and remember may not be essential for retention, the pupil must still have an intent to carry out the instructions given; "in a sense a student has complete veto power over learning ..." (Rothkopf, 1970, P326).

As to the actual learning-memory strategies which pupils could be instructed to use; pictorial imagery and logical comparisons have been shown, in the subsidiary study, to be two strategies which pupils may be instructed to use to bring about the processing required for effective learning and retention. However, as has been stated, these are by no means the only strategies which pupils can be instructed to use to effect learning and retention and may well not be even the most effective strategies. This then is a matter requiring further research.

III RETRIEVAL PROCESSES AND OTHER FACTORS REQUIRING FURTHER STUDY

To this point, the suggestion seems to be that if 'full and meaningful processing' is achieved during storage, then retention is somehow virtually automatic. It must be made clear that even if so called full and meaningful processing is achieved during study of the to-be-remembered material, this does not necessarily ensure retention several weeks later. This paper has concentrated on the storage aspects of remembering and has largely neglected discussion of the processes involved in retrieval. There is a need for further research into factors operating both during the retention period and when retrieval is attempted, which may prevent stored information from being retrieved. An example of this can be seen in the major study, where pupils, up to 2 hours after studying the passage, reported parts of it as standing out in their minds, but often did not recall these facts in the O.E. test 4 weeks and 5 days later.

There are in fact a number of variables which were held constant or given little consideration in this present research, which may be important factors in learning and retention. For example what results would be obtained if similar research was carried out with Ss of a different age (say Standard I or Form VII). With older Ss, would experimenter imposed learning-memory strategies still produce comparable results to informing Ss of a forthcoming post-test and letting them decide the most suitable strategy to use? Would the results differ for differing retention periods? Would they differ according to the nature of the to-be-

remembered material?

Also what effects do the varying antecedent characteristics of S have on learning and retention? Take as an example the results of the major study, which suggest that the extent of Ss' previous reading on the topic covered by the retention passage, greatly influences learning and retention. Such a factor may well affect the motivational state of Ss, their interest in the passage, their degree of concentration while studying the passage, the meaning which they give to the passage material and the depth at which the material is processed. "It is then quite logical to infer that the greatest limiting or facilitating factor in the processing of information is the existing information in the LTS." (Kumar, 1971, P405). For the pupil who has previously read on the passage topic, study of much of the to-be-remembered material may merely be a case of relearning, thus providing more time and a more comprehensive knowledge base, with which to process the 'new' passage material.

There is also a need for further research into the effect of experimenter instructions of strategy use, on the actual processing which takes place and on later retrieval. Perhaps even of the effect of having the experimenter (teacher) work with the pupils during processing. These are some of the many issues raised by the present study which require further research.

IV LEARNING-MEMORY PROCESSES

The nature of the present research, its results, and

the nature of the issues it raises, reaffirm the view that in our present state of knowledge (or more correctly, ignorance) of what actually constitutes our cognitive processes, it is desirable to consider together learning and memory processes, when dealing with meaningful written material. Indeed there are times when we wish to distinguish between 'learning' and 'memory' (Shuell and Keppel, 1970) and as is pointed out in Chapter I (p 10), we can by definition (even if it may be more difficult in practice) distinguish between the two. However, to a great extent, those cognitive processes influencing learning are those which also influence memory. Furthermore, 'real-life' situations require us to both learn and remember; one without the other would be of little or no use.

V MEASURING RETENTION

In research involving the learning and remembering of written material, it must be decided how retention is to be measured. As stated in Chapter I, retention is generally measured by either an O.E. recall or a M.C. recognition test. This raises two major questions: (i) In what ways do the O.E. and M.C. tests differ as measures of retention? (ii) Are these two measures of retention, as traditionally presented and scores, the most meaningful measures of retention or simply the most convenient?

Unfortunately the design of this study and the problems posed in attempting to compare O.E. and M.C. test scores, makes it difficult to draw any conclusions or even to explain some of the results gained. Despite this however,

through consideration of the effects of various study variables and trends in test scores, a number of worthwhile observations and suppositions can be made.

One finding which suggests a difference between O.E. and M.C. tests as retention measures, is that in both the major and subsidiary studies there was often considerable difference between the two retention measures in terms of the effects of strategy use on retention. Take as an example from the subsidiary study, the F ratios and significance levels for the simple effects of strategy use on retention, at each of the reading levels (see Table XXV). Here the effect of strategy use for the top reading level was significant ($P<.001$) for the O.E. test but not for the M.C. test. For the second reading level there was again a significant ($P<.05$) effect for the O.E. test but not for the M.C. test. Finally, at the third reading level the effect was non-significant for the O.E. test but significant ($P<.001$) for the M.C. test.

In regards to the question of process differences between recall and recognition, it appears that pupils do indeed use different operations when sitting a recognition as compared with a recall test. This does not however mean that there is necessarily a difference in the processes involved in these two forms of retention. It definitely does not mean that recognition tests eliminate the need for retrieval of stored information (c.f. Kintsch, 1970). Recognition still requires retrieval of stored information so that a meaningful selection can be made from the alternatives. The difference is that in a M.C. type recognition test, the question (stem)

and alternatives for each item provide S with cues which may aid the retrieval of the appropriate information.
In contrast in an O.E. test one brief question is all Ss get to help them locate and reproduce a considerable amount of information. A short answer recall test (as frequently used in the classroom situation) would thus come somewhere between an O.E. and a M.C. test, in terms of the cues provided for S at retrieval.

Another difference between O.E. and M.C. tests, which may help account for some of the results obtained, is that in an O.E. test S is given credit for any information which he/she can recall (from the to-be-remembered material). However in a M.C. test S only gets credit for retained information which corresponds with the questions asked.

At this point it is also worth noting Form I pupils' approach to M.C. tests. Pupils at this level seem inclined to over estimate the easiness of M.C. tests. In many cases they hurriedly read the stem (question), skim over the alternatives (in some cases not even considering all alternatives), and select the first alternative which appears to them to be related to the question. They are thus easily fooled by false alternatives which are similar to the correct alternative. They seldom see the need for retrieving information (Kintsch, 1970) relevant to the item in question, so that a meaningful discrimination can be made between the alternatives.

The second question raised in regards to the measuring of retention is, by what means should retention in fact be

measured. It would seem that O.E. recall and M.C. recognition tests are not always used because they provide the most meaningful measure of learning and retention, but often because they are the easiest way out. If we are to fully understand the processes involved in learning and memory we must extend our measures of retention beyond 'correct' recognition and recall of information presented in the to-be-remembered material. If we are to gain an accurate measure of the meaning pupils derive from the to-be-remembered material and the extent of their knowledge and understanding of the topic under consideration; we must also consider pupils' misinterpretations of the to-be-remembered material, their recall of facts relevant to the topic under consideration but not presented in the to-be-remembered material, and their false recall and recognition. As stated earlier, the meaning gained from the written words by the reader may not necessarily be that intended by the writer (or tester). Thus a pupil may initially falsely learn and store some material and although this information is recalled by them when tested, no credit can be given. Obviously traditional retention tests are a measure of not only retention but also original learning and understanding.

Admittedly it may not always be practical for the classroom teacher (or researcher) to gain such a comprehensive measure of learning and retention as suggested above. However for those involved in learning-memory research, use of an O.E. test of retention and consideration of all answers given (whether or not they are correct) is likely to provide some valuable insights into pupils' learning-memory processes.

A further matter requiring consideration, is the criteria used in scoring an O.E. test. The method of marking used in the present subsidiary study proved more precise and meaningful for research on learning and memory, than the criteria for scoring generally used, where credit is given only for each basic correct idea recalled from the passage. In this subsidiary study, credit was also given for each word or phrase which expanded on the basic idea. This is one of the few ways in which pupils can systematically be given credit for the precision (and comprehensiveness) of their recall. This does however raise the question of whether in this study some pupils had the necessary understanding and retention to make more precise and comprehensive recall statements, but owing to past experience of recall test requirements and the tendency for pupils to follow a principle of least effort (Anderson, 1970), they only reproduced the basic ideas. In future research it may well prove worthwhile to consider whether some study strategies are more inclined to result in pupils recalling only basic ideas and others likely to result in more precise and comprehensive recall.

VI RESEARCH DESIGN

This then brings us to the issue of research design, of which a number of aspects have already been touched on in the discussion of other issues. The major study presented here was by nature very general. As it covered a wide range of issues in relatively little depth, it was difficult to draw definitive conclusions from the results. However it did

provide valuable basic information on pupils' knowledge and understanding of their own learning-memory processes, their ability to verbalize this knowledge and the sort of strategies they understand themselves to be using. Unfortunately little could be concluded about the effect of the various strategies on retention. Although, as stated, it may well be that it does not so much matter what activities pupils engage in to process the to-be-remembered material, but rather that they do in fact process it in a meaningful way. This being a view for which the results of the subsidiary study provided some support.

A problem arising from the use of a structured interview technique, was that of verbal bias (see Hagen's commentary to Kreutzer et al, 1975). As a result of the verbal skills required of the pupils in the interview situation, the more eloquent pupils appeared to have a greater knowledge and understanding of their own learning-memory processes. Thus metamemory was inclined to become more the pupils' verbalizable, rather than their potentially verbalizable, knowledge and awareness of factors influencing information storage and retrieval (Kreutzer et al, 1975).

As for the subsidiary study, the basic design used here proved an effective means of determining the relative advantages of instructions to use various learning-memory strategies. It was unfortunate that in this study there was a relatively high drop-out rate of pupils from the knowledge of test group (for reasons unrelated to the study variables) and that these drop-outs were predominantly of low ability. The use of reading level as a moderator variable, however

largely overcame this problem and provided some valuable insights into the effect of reading ability on learning and retention of written material. A similar design to that used here could well be used to advantage in other research of the effects of various types of teacher instructions and the teaching of retention skills, on learning and retention. This could be carried out for a variety of learning-memory strategies and for subjects of varying ages.

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APPENDIX A PASSAGE USED IN INITIAL EXPLORATORY STUDY

Three Enemies of the High Country Farmer

The kea, rabbit, and deer have all at some time proved a problem for the high country farmer.

The kea is a native parrot of New Zealand. It lives in the mountainous and bush-clad areas of the South Island. Its feathers are dark green except for those under the wings which are a flamey orange. The kea's beak is long, curved and very strong. Its usual foods are alpine berries and grubs which it digs from the ground and from rotting logs which it tears to pieces with its beak. In late winter and early spring, when berries are scarce, keas become very hungry and look for other sources of food.

In the past, keas have killed hundreds of sheep. One way in which they do this is by digging their beaks into the sheep's backs, causing blood poisoning, which kills the sheep. However most sheep are now inoculated to prevent blood poisoning; but still, large wounds can often be seen on the sheep's backs when they are brought in for shearing.

Rabbits were also a serious problem for the high country farmer until the Rabbit Board began to carry out its plan of wiping out all rabbits. Rabbits are a problem because they deprive sheep and cattle of their food, dig warrens in the ground, and in the winter eat the bark off young trees and shrubs.

The red deer were also a problem, and in some areas still are; although thousands have now been shot by Government shooters and skin hunters. One way in which the deer are a problem is that at night they sometimes come out onto the flats and eat pastures that are being used to feed sheep and cattle. Even more seriously however, they eat the seedling trees, kill mature trees by rubbing off the bark with their antlers and also destroy other native plants. This may then result in erosion.

APPENDIX B MAJOR STUDY - RETENTION PASSAGE AND BREAKDOWN OF FACTS.

1. Passage as Presented to Pupils.

2. Breakdown of Passage by Facts.

3. Examples of General Stand-Out Facts.

DANGEROUS WIND MOVEMENTS

TORNADOES

The tornado is a whirlingwindstorm. It looks like a funnel hanging down from a dark cloud. It may whirl either clock-wise or counter-clockwise. Its path is usually less than a mile in width.

The winds within the tornado are fierce and strong. They are both vertical and horizontal. The vertical winds may blow at 200 miles per hour. The horizontal winds may reach 300 miles per hour. A tornado that takes place over the ocean or any other large body of water is called a 'waterspout'.

Tornadoes occur most often during the spring and summer. It is during these seasons that the differences in temperature between warm and cold masses of air are greatest. Hence this is the time in which warm air is most likely to meet fast-moving cold fronts.

A tornado is formed when there is a layer of warm moist air on the ground with a layer of cold dry air above it. The cold dry air keeps the warm moist air from rising. Then along comes a rapid moving cold front. This cold front pushes in under the warm air and lifts it up. The warm air caught between two layers of cold air suddenly bursts through the layer of cold air above and rushes

upward. More warm air follows with a force that results in a whirling tornado.

The winds are so strong that they can pick up objects as heavy as an automobile. They make houses and other buildings collapse. They carry loose timber and other objects with them for long distances. They cause the death of many people and millions of dollars of damage.

HURRICANES

Hurricanes are larger than tornadoes. Some are 100 to 400 miles across. They are also more violent than tornadoes.

Hurricanes form over tropical oceans when a large mass of air becomes heated more than usual. As a result a great spiral-shaped, counter-clockwise movement of air is caused. This may take place over an area of hundreds of square miles.

An unusual feature of a hurricane is its 'eye'. The eye is an area in the centre of the hurricane. It is roughly circular in shape and from 20 to 30 miles wide. This region is calm. The hurricanes strongest winds are just outside the eye. On the rim of the eye they may be more than 150 miles per hour. Birds sometimes take refuge in the calm area and ride along with the storm. Ships have also been known to take refuge in the eye while riding out the worst of the

storm.

Hurricanes move more slowly than tornadoes. This makes it possible to track them by aeroplane and radio. Information thus obtained can be given to people in the path of the hurricane. This enables them to prepare in advance.

Hurricanes often strike the South Sea Islands and the Philippines. These hurricanes arise from tropical waters near the equator. In this part of the world hurricanes are called 'typhoons'. Hurricanes and typhoons are the same thing. They are just called different names in different parts of the world.

B.2. DANGEROUS WIND MOVEMENTS: BREAKDOWN OF PASSAGE BY FACTS.

TORNADOES

1. The tornado is a whirling windstorm.
2. It looks like a funnel hanging down from a dark cloud.
3. It may whirl either clockwise ($\frac{1}{2}$ mark) or counter clock-wise ($\frac{1}{2}$ mark).
4. Its path is usually less than a mile in width.
5. The winds within a tornado are fierce and strong.
6. They are both vertical ($\frac{1}{2}$ mark) and horizontal ($\frac{1}{2}$ mark).
7. The vertical winds may blow at 200 miles per hour.
8. The horizontal winds may reach 300 miles per hour.
9. A tornado that takes place over the ocean or any other large body of water is called a waterspout.
10. Tornadoes occur most often during the spring ($\frac{1}{2}$ mark) and summer ($\frac{1}{2}$ mark).
11. It is during these seasons that differences in temperature between warm and cold masses of air are greatest.
12. Hence this is the time in which warm air is most likely to meet fast moving cold fronts.
13. A tornado is formed when there is a layer of
    (a) warm moist air on the ground with
    (b) a layer of cold dry air above it.
14. The cold dry air keeps the warm moist air from rising.
15. Then along comes a rapid moving cold front.
16. (a) This cold front pushes in under the warm air and
    (b) lifts it up.

17. (a) The warm air caught between two layers of cold air
(b) suddenly bursts through the layer of cold air above and
(c) rushes upward.

18. (a) More warm air follows
(b) with a force that results in a whirling tornado.

19. The winds are so strong that they can pick up objects as heavy as an automobile.

20. They make houses and other buildings collapse.

21. They carry loose timber and other objects with them for long distances.

22. They (a) cause the death of many people and
(b) millions of dollars of damage.

HURRICANES

23. Hurricanes are larger than tornadoes.

24. Some are 100 to 400 miles across.

25. They are also more violent than tornadoes.

26. (a) Hurricanes form over tropical oceans when
(b) a large mass of air becomes heated more than usual.

27. As a result a great (a) spiral-shaped (b) counter clock-wise movement of air is caused.

28. This may take place over an area of hundreds of square miles.

29. An unusual feature of a hurricane is its eye.

30. The eye is an area in the centre of the hurricane.

31. (a) It is roughly circular in shape and
(b) from 20 to 30 miles wide.

32. This region is calm.

33. The Hurricane's strongest winds are just outside the eye.

34. On the rim of the eye they may be more than 150 miles per hour.

35. Birds sometimes (a) take refuge in the calm area and (b) ride along with the storm.

36. (a) Ships have also been known to take refuge in the eye while

(b) riding out the worst of the storm.

37. Hurricanes move more slowly than tornadoes.

38. This makes it possible to track them by (a) aeroplane and (b) radio.

39. Information thus obtained can be given to people in the path of the hurricane.

40. This enables them to prepare in advance.

41. Hurricanes often strike the (a) South Sea Islands and (b) the Philippines.

42. These hurricanes arise from (a) tropical waters

(b) near the equator.

43. In this part of the world hurricanes are called 'typhoons'.

44. Hurricanes and typhoons are the same thing.

45. They are just called different names in different parts of the world.

B.3. EXAMPLES OF GENERAL STAND-OUT FACTS

Facts 91 - 95 were general ideas, reported by pupils as standing out in their mind, which could not be identified with any one specific sentence from the passage, e.g.:

91 - Size

"How big they are."

"How wide they are."

92 - Speed

"Like how fast they go."

"Aw, mainly the miles per hour; how fast they go."

93 - Formation

"The bit that tells how the hurricanes and tornadoes started ..."

"Aw, just about the air temperature."

94 - Destruction

"... what they can do."

"... all the damage it can do."

95 - Eye

"I think the bit about the eye."

"Well the eye of the hurricane, I remember that well."

APPENDIX C INTERVIEW SCHEDULES.

1. Draft Interview Schedule.

2. Revised Interview Schedule.

C.1. DRAFT INTERVIEW SCHEDULE.

1. Did you find the passage interesting?
2. Have you done any previous reading about hurricanes and tornadoes?
3. Did you read all the passage more than once or just parts of it?
4. Did you understand the passage?
5. Did you note down any important points? Why?
6. Did you do anything special to help you remember?
7. Were there any parts of the passage which stand out in your mind? Why?
8. Did you select parts you thought should be remembered and forget about others?
   (If 'yes') - What were your reasons for selecting or forgetting about these points?
9. Would you have treated the passage in the same way if you were not going to be tested?
10. What sort of test do you think I will give?
11. Did you ask yourself questions to see if you could remember the important points?
12. Did you repeat any important words or sentences to yourself?
13. Did any parts of the passage remind you of things you have done or seen?
14. (a) What do you imagine it would be like in an area that a hurricane or tornado was passing through?
    (b) Did you imagine what it would be like as you read the passage?
15. Are there any other ways you know of helping you to remember things, which you didn't use here?

C.2. REVISED INTERVIEW SCHEDULE

1. How interesting did you find the passage?
2. Have you done any previous reading about hurricanes and tornadoes?
3. Did you read all the passage more than once or just parts of it?
4. Did you understand the passage or did you have some difficulties?
5. Did you note down any important points? Why?
6. What did you do to help you remember?
7. Were there any parts of the passage which stand out in your mind? Why?
8. Did you select parts you thought should be remembered and forget about other parts?
   (If 'yes') - What were your reasons for selecting or forgetting about these points?
9. Would you have treated the passage in the same way if you were not going to be tested?
10. What sort of test do you think I will give?
11. Did you ask yourself questions to see if you could remember the important points?
12. Did you repeat any important words or sentences to yourself?
13. As you were reading the passage did any parts of it remind you of things you have done or seen?
14. (a) What do you imagine it would be like in an area that a hurricane or tornado was passing through?
    (b) Did you think in terms of words or did you form pictures in your mind?

15. Are there any other ways you know of helping you remember things, which you didn't use here?

APPENDIX D POST-TESTS FOR MAJOR STUDY.

1. Pupils' Instruction and Record Sheet for Predicted Recall.

2. O.E. Test - Pupils' Instruction and Answer Sheet (Tornadoes).

3. O.E. Test - Pupils' Instruction and Answer Sheet (Hurricanes).

4. M.C. Test - Pupils' Instruction Sheet and Test Items.

5. M.C. Test - Pupils' Answer Sheet.

TEST

DANGEROUS WIND MOVEMENTS

NAME: _____

ROOM _____ SCHOOL _____

How many of the important points from the passage on hurricanes and tornadoes, which you read 4 weeks ago, do you think you can remember?

Place a tick in the appropriate box. ☑

None	A few	About half	Most	Nearly all
☐	☐	☐	☐	☐

TEST

DANGEROUS WIND MOVEMENTS

NAME: _____

1. TORNADOES

Note down on this page all you can remember about tornadoes.

You do NOT have to write complete sentences. You can write it down in note form.

You must note down everything you can remember about tornadoes.

TEST

DANGEROUS WIND MOVEMENTS

NAME: _____

2. HURRICANES

Note down on this page all you can remember about hurricanes.

You do NOT have to write complete sentences. You can write it down in note form.

You must note down everything you can remember about hurricanes.

TEST

DANGEROUS WIND MOVEMENTS

This is a test to see how much you can remember from the passage about hurricanes and tornadoes which you read 4 weeks ago.

You are to answer all eleven questions. Four possible answers are given for each question. You are to choose the ONE correct answer for each question.

Here is an example:

S.1 A hurricane which takes place over water is called a

(A) 'watertrough'
(B) 'waterspout'
(C) 'whirlwind'
(D) 'waterwind'

The correct answer is 'waterspout'. You will see that 'waterspout' has the letter (B) in front of it. Now look at your answer sheet.

Beside S.1 write the letter 'B' in the brackets. This is how you will answer the questions. In the brackets ( ), just print the letter of the answer you choose.

Answer every question even when you are not sure of your answer. Do not spend too much time on questions you find hard.

You have 12 minutes to complete the test.

DO NOT START UNTIL YOU ARE TOLD.

DO NOT MARK THE QUESTION SHEETS.

1. A tornado is a
   (A) period of bad weather
   (B) very strong wind
   (C) thunder storm
   (D) sun shower

2. The calm region in the centre of a hurricane is called the
   (A) rim
   (B) mouth
   (C) eye
   (D) funnel

3. The width of a tornado's path is usually
   (A) less than 1 mile
   (B) 10 to 20 miles
   (C) 50 to 100 miles
   (D) more than 100 miles

4. Vertical winds in a tornado may blow at 200 miles per hour and horizontal winds at
   (A) 50 miles per hour
   (B) 100 miles per hour
   (C) 250 miles per hour
   (D) 300 miles per hour

5. In the formation of a tornado the warm moist air is kept from rising by
   (A) a cold front
   (B) a warm front
   (C) cold moist air
   (D) cold dry air

6. Tornadoes occur most often during the
   (A) spring and summer
   (B) autumn and winter
   (C) summer and autumn
   (D) winter and summer

7. The wind movement of a tornado is
   (A) only clockwise
   (B) only counter-clockwise
   (C) both clockwise and counter-clockwise
   (D) neither clockwise nor counter-clockwise

8. A typhoon is
   (A) a special type of tornado
   (B) another name for a hurricane
   (C) another name for a tornado
   (D) a special type of hurricane

9. Hurricanes form over
   (A) Arctic oceans
   (B) Tropical oceans
   (C) Tropical land masses
   (D) Arctic land masses

10. The strongest winds in a hurricane are found
   (A) just outside the eye
   (B) in the centre of the eye
   (C) 50 miles from the eye
   (D) on the hurricane's outer edges

11. Hurricanes are easier to track than tornadoes because they
   (A) are wider
   (B) take place over land
   (C) are more violent
   (D) are slower

TEST

DANGEROUS WIND MOVEMENTS

NAME: _____

ROOM _____ SCHOOL _____

ANSWER SHEET

Sample Answer S.1. ( )

1. ( )
2. ( )
3. ( )
4. ( )
5. ( )
6. ( )
7. ( )
8. ( )
9. ( )
10. ( )
11. ( )

APPENDIX E REGRESSION ANALYSIS SUMMARY TABLES

Table A - Regression Analysis Summary Table for O.E. Residual Scores.

Table B - Regression Analysis Summary Table for M.C. Residual Scores.

TABLE A - Regression Analysis Summary Table for O.E. Residual Scores.

Variable	MultipleR	R Square	R Sq.Change	Simple R	B
Sex	0.04212	0.00177	0.00177	0.04212	0.06645
Age	0.04214	0.00178	0.00000	0.00501	0.01904
I.Q.	0.40975	0.16790	0.16612	0.39702	0.04134
Rdg.Comp.(Raw)	0.47329	0.22400	0.05611	0.45520	0.13536
Constant					-6.30555

TABLE B - Regression Analysis Summary Table for M.C. Residual Scores.

Variable	MultipleR	R Square	R Sq.Change	Simple R	B
Sex	0.19912	0.03965	0.03965	-0.19912	-0.80458
Age	0.22656	0.05133	0.01168	-0.12602	-0.00535
I.Q.	0.47313	0.22385	0.17253	0.40588	0.02639
Rdg.Comp.(Raw)	0.53228	0.28332	0.05946	0.47187	0.08857
Constant					2.29328

APPENDIX F ANOVA SUMMARY TABLES FOR MAJOR STUDY.

Table C - ANOVA Summary Table. Criterion: O.E. Test Scores.

Table D - ANOVA Summary Table. Criterion: M.C. Test Scores.

Table E - ANOVA Summary Table. Criterion: O.E. Residual Test Scores.

Table F - ANOVA Summary Table. Criterion: M.C. Residual Test Scores.

Table C - ANOVA Summary Table. Criterion: O.E. Test Scores.

Source Variance	S.S.	d.f.	M.S.	F
Interest				
Between Gps.	8.7812	1	8.7812	1.1287
Within Gps.	326.7642	42	7.7801	
Previous Reading				
Between Gps.	86.3640	2	43.1820	7.1051
Within Gps.	249.1815	41	6.0776	
Number Times Read				
Between Gps.	14.1220	2	7.0610	1.0267
Within Gps.	268.2113	39	6.8772	
Selective Reading				
Between Gps.	47.3033	1	47.3033	6.8926
Within Gps.	288.2422	42	6.8629	
Understanding				
Between Gps.	26.0684	1	26.0684	3.5378
Within Gps.	309.4771	42	7.3685	
Notes				
Between Gps.	17.7164	1	17.7164	2.3412
Within Gps.	317.8291	42	7.5674	
Selective Learning				
Between Gps.	16.0038	1	16.0038	2.1035
Within Gps.	319.5417	42	7.6081	
Test Effect				
Between Gps.	16.4493	1	16.4493	2.1651
Within Gps.	319.0962	42	7.5975	
Self Testing				
Between Gps.	5.8666	1	5.8666	0.7754
Within Gps.	318.4125	41	7.7662	
General Recall				
Between Gps.	8.6366	1	8.6366	1.1096
Within Gps.	326.9089	42	7.7835	
Repetition				
Between Gps.	11.8938	1	11.8938	1.5795
Within Gps.	308.7341	41	7.5301	
Association Exper.				
Between Gps.	16.1352	2	8.0676	1.0356
Within Gps.	319.4103	41	7.7905	
Pictorial Imagery				
Between Gps.	29.7231	1	29.7231	4.0820
Within Gps.	305.8224	42	7.2815	
Verbal Thought				
Between Gps.	8.6972	1	8.6972	1.1176
Within Gps.	326.8483	42	7.7821	

Table D - ANOVA Summary Table. Criterion: M.C. Test Scores.

Source Variance	S.S.	d.f.	M.S.	F
Interest				
Between Gps.	0.6432	1	0.6432	0.1757
Within Gps.	153.7886	42	3.6616	
Previous Reading				
Between Gps.	23.5644	2	11.7822	3.6913
Within Gps.	130.8674	41	3.1919	
Number Times Read				
Between Gps.	1.8720	2	0.9360	0.2534
Within Gps.	144.0327	39	3.6931	
Selective Reading				
Between Gps.	6.2131	1	6.2131	1.7606
Within Gps.	148.2188	42	3.5290	
Understanding				
Between Gps.	16.1485	1	16.1485	4.9047
Within Gps.	138.2833	42	3.2925	
Notes				
Between Gps.	4.6669	1	4.6669	1.3088
Within Gps.	149.7650	42	3.5658	
Selective Learning				
Between Gps.	0.6402	1	0.6402	0.1748
Within Gps.	153.7917	42	3.6617	
Test Effect				
Between Gps.	1.5387	1	1.5387	0.4227
Within Gps.	152.8932	42	3.6403	
Self Testing				
Between Gps.	3.2160	1	3.2160	0.8766
Within Gps.	150.4119	41	3.6686	
General Recall				
Between Gps.	15.5152	1	15.5152	4.6908
Within Gps.	138.9167	42	3.3075	
Repetition				
Between Gps.	8.6978	1	8.6978	2.5262
Within Gps.	141.1627	41	3.4430	
Association Exper.				
Between Gps.	5.6754	2	2.8377	0.7821
Within Gps.	148.7564	41	3.6282	
Pictorial Imagery				
Between Gps.	10.3237	1	10.3237	3.0088
Within Gps.	144.1081	42	3.4311	
Verbal Thought				
Between Gps.	1.0985	1	1.0985	0.3009
Within Gps.	153.3333	42	3.6508	

Table E - ANOVA Summary Table. Criterion: O.E. Residual Test Scores.

Source Variance	S.S.	d.f.	M.S.	F
Interest				
Between Gps.	1.6639	1	1.6639	0.4210
Within Gps.	158.0957	40	3.9524	
Previous Reading				
Between Gps.	31.9674	2	15.9837	4.8780
Within Gps.	127.7921	39	3.2769	
Number Times Read				
Between Gps.	3.1446	2	1.5723	0.4490
Within Gps.	129.5562	37	3.5015	
Selective Reading				
Between Gps.	8.6869	1	8.6869	2.3001
Within Gps.	151.0727	40	3.7768	
Understanding				
Between Gps.	0.2319	1	0.2319	0.0581
Within Gps.	159.5277	40	3.9882	
Notes				
Between Gps.	2.8799	1	2.8799	0.7343
Within Gps.	156.8797	40	3.9220	
Selective Learning				
Between Gps.	6.8842	1	6.8842	1.8013
Within Gps.	152.8753	40	3.8219	
Test Effect				
Between Gps.	0.1649	1	0.1649	0.0413
Within Gps.	159.5947	40	3.9899	
Self Testing				
Between Gps.	0.5861	1	0.5861	0.1756
Within Gps.	130.1559	39	3.3373	
General Recall				
Between Gps.	1.0676	1	1.0676	0.2691
Within Gps.	158.6920	40	3.9673	
Repetition				
Between Gps.	3.8059	1	3.8059	0.9717
Within Gps.	152.7541	39	3.9168	
Association Exper.				
Between Gps.	8.1771	2	4.0885	1.0519
Within Gps.	151.5825	39	3.8867	
Pictorial Imagery				
Between Gps.	10.1372	1	10.1372	2.7101
Within Gps.	149.6224	40	3.7406	
Verbal Thought				
Between Gps.	2.6779	1	2.6779	0.6819
Within Gps.	157.0816	40	3.9270	

Table F - ANOVA Summary Table. Criterion: M.C. Residual Test Scores.

Source Variance	S.S.	d.f.	M.S.	F
Interest				
Between Gps.	0.3579	1	0.3579	0.1854
Within Gps.	77.2234	40	1.9306	
Previous Reading				
Between Gps.	3.7292	2	1.8646	0.9847
Within Gps.	73.8521	39	1.8936	
Number Times Read				
Between Gps.	0.1782	2	0.0891	0.0450
Within Gps.	73.1997	37	1.9784	
Selective Reading				
Between Gps.	0.9037	1	0.9037	0.4714
Within Gps.	76.6776	40	1.9169	
Understanding				
Between Gps.	2.5570	1	2.5570	1.3633
Within Gps.	75.0243	40	1.8756	
Notes				
Between Gps.	1.5339	1	1.5339	0.8068
Within Gps.	76.0474	40	1.9012	
Selective Learning				
Between Gps.	0.0673	1	0.0673	0.0347
Within Gps.	77.5140	40	1.9378	
Test Effect				
Between Gps.	2.2595	1	2.2595	1.1999
Within Gps.	75.3217	40	1.8830	
Self Testing				
Between Gps.	4.2524	1	4.2524	2.2864
Within Gps.	72.5369	39	1.8599	
General Recall				
Between Gps.	0.1650	1	0.1650	0.0852
Within Gps.	77.4163	40	1.9354	
Repetition				
Between Gps.	0.4001	1	0.4001	0.2043
Within Gps.	76.3919	39	1.9588	
Association Exper.				
Between Gps.	2.3998	2	1.1999	0.6224
Within Gps.	75.1815	39	1.9277	
Pictorial Imagery				
Between Gps.	1.2659	1	1.2659	0.6635
Within Gps.	76.3154	40	1.9079	
Verbal Thought				
Between Gps.	2.7248	1	2.7248	1.4560
Within Gps.	74.8565	40	1.8714	

APPENDIX G SUBSIDIARY STUDY - RETENTION PASSAGE AND INSTRUCTIONS

1. Retention Passage as Presented to Pupils.
2. Teachers' Instructions.
3. Instruction and Response Sheet for Incidental Group.
4. Instruction and Response Sheets for Logical Comparisons Group.
5. Instruction Sheet for Pictorial Imagery Group.
6. Instruction Sheet for Knowledge of Test Group.

THE GREAT MUD CITY OF KANO

Kano is a market city in northern Nigeria. To this market city come two peoples. From the north out of the Sahara, come the wandering desert Arabs. From the hill and forest regions of the south come African Negroes of various tribes. Kano itself is the home of the Hausas, famous as craftsmen and merchants. They came across the desert from Sudan a thousand years ago.

The old city of Kano is enclosed by a great mud wall. Outside the wall there is a modern town where the British officials and advisers live. Within the wall Kano is just as it was 500 years ago. The wall is about twelve miles round. In some places it is fifty feet high and forty feet thick at the base. It is built of mud, nothing but mud. The men who built it allowed enough space inside for crops to be grown in case the city was besieged. For in those days there was much savage tribal fighting and slave-raiding. Today there are over 100,000 people living in Kano.

Not only is the wall made of mud, but the houses are also made of mud. The small, neat mud houses are huddled along winding alleyways. There are round ones and square ones, and from the air they look like upturned tins and cardboard boxes. If you want to build a house you did up the dry clayey soil and mix it to a thick paste with water. This is then used to make the walls. After making the walls, rafters are laid across, to form a flat roof which is finished off with a coating of mud. The rafters are generally cut from a special kind of palm which the white ants do not like. These ants will eat almost anything, from bank notes and shoes, to the wooden parts of your house. Luckily, this palm-wood is too hard for them.

Projecting from the roofs of all the houses are gutter-pipes. The city of Kano is on a sun-baked plain growing only thorn-scrub and parched grass. There is little rain. However, in May and June the lightning starts to flicker in the stifling heat; then with the crash of thunder, rain pours from the black clouds. The houses would soon dissolve if the water ran down the walls, but the gutter-pipes send thousands of little waterfalls into the alleys. In no time at all the sun comes out again and rebakes the wet roofs.

The 'streets' of Kano are crowded with people and animals. At the centre of the city is the great open market-place. Here hens peck and scratch, donkeys lie in the gutters and camels sway through the crowds of people. Goats and sheep are also found lying along the walls in the shade. Sometimes you will see a donkey looking out of a doorway, while small children push past it, in and out of the house.

There are also thousands of people riding bikes; bumping and wobbling along with their bells ringing. Many cyclists carry huge coloured umbrellas as sun-shades, which makes riding difficult. There are many spills and noisy arguments as pedestrians are knocked over by cyclists.

It is the ambition of every Hausa to own a bicycle. When the new bicycles are bought, the handlebars and frame are wound round with paper. The bike owners think the best way to keep them clean is to leave the paper on. This means you often see bicycles which have been used for many years, still wrapped up. Instead of service stations there are many puncture menders sitting by the roadside, with a bike-pump and repair outfit. There are even bicycle taxis, but the passengers look scared and uncomfortable bouncing along on the carrier.

The market is noisy and lively, but also very smelly because everyone throws their garbage into the middle of the street. This is where the vultures play their part. They perch on the house-tops and tall trees and fight over the food scraps as they are thrown into the street. Nobody harms them because they know the lanes would be full of rubbish if the vultures went on 'strike'.

TEACHERS' INSTRUCTIONS

N.B. Teachers please follow these instructions, exactly as stated and maintain a 'test atmosphere' throughout.

Say - "You have been chosen to take part in a study of children's reading and studying habits being carried out by the university. It is important that you do the best you can and follow the instructions given carefully.
Shortly you will be given, face down, a passage about an unusual city. Do not turn it over until you are told to do so."

(Hand out passages face down. When all pupils have a passage, continue:)

Say - "Turn your papers over and follow the instructions on the front page as I read them aloud".

(Read the instruction from your copy of the passage. After answering any questions which may arise, continue:)

Say - "You now have 20 minutes to study the passage. Begin now."

(Call the time after 5 minutes, 10 minutes, 15 minutes, and 'time-up' (20 minutes)).

INSTRUCTIONS

NAME: _____ ROOM: _____

We would like to find out how carefully you can read. You will have 20 minutes to read the passage and find out the following:

a) How many times does the word 'Kano' appear in the passage? Answer here _____

b) How many times does the word 'the' appear in the passage? Answer here _____

c) How many commas (,) are there in the passage? Answer here _____

Do not mark the passage itself.

Do not begin reading until you are told to do so.

Before you begin reading write your name and room at the top of this sheet.

Are there any questions?

Remember to read the passage as carefully as you can. If you finish before the 20 minutes is up, go back and check that you have not made any mistakes.

INSTRUCTIONS

The following passage tells us about the city of Kano. From this passage we can see that Kano differs from Christchurch in many ways.

You have 20 minutes in which to read the passage carefully and list on the answer sheet, all the ways in which you think Kano is different from Christchurch.

You do not have to write complete sentences.
Write your notes on the answer sheet provided.
These will be collected and marked.
Do not write on the passage itself.
Do not begin reading until you are told to do so.
Before you begin reading, write your name and class on the answer sheet.

Are there any questions?

Remember that your task is to list all of the ways in which you think Kano is different from Christchurch.

ANSWER SHEET

NAME: _____ ROOM: _____

List on this sheet all the ways in which you think Kano is different from Christchurch.

INSTRUCTIONS

Read this passage carefully.

As you read it, picture in your mind what the passage describes.

For example, imagine what the great mud wall would look like. Form a picture in your mind of Kano on market day; the narrow winding streets and the crowds of bustling people.

Try to picture in your mind everything you read.

You will have 20 minutes to read the passage and picture what you read.

Do this carefully, as you will later be given work to do, which depends on your having pictured in detail, all that the passage tells you about.

Do not write on the passage.

Do not begin reading until you are told to do so.

Are there any questions?

Remember, it is important for you to try to picture in your mind everything that you read.

INSTRUCTIONS

Read this passage carefully.

In three weeks time you will be given a test to see how well you understood the passage and how many of the important points you can remember.

You may use any method you wish to learn and remember the important points. Use whichever method you think will be best for you.

Do not mark the passage.

You may take notes on another piece of paper if you wish. However, these notes will be collected and you will not be able to refer to them later.

You will have 20 minutes in which to learn and remember the important points.

Do not begin reading until you are told to do so.

Are there any questions?

Remember, you will be tested in three weeks time. Try to understand and remember it as well as you can.

APPENDIX H SUBSIDIARY STUDY - TEACHERS' AND PUPILS' INSTRUCTIONS, AND POST-TESTS.

1. Teachers' Instructions for Test Administration.

2. O.E. Test - Pupils' Instruction and Answer Sheet.

3. M.C. Test - Pupils' Instruction Sheet and Test Items.

4. M.C. Test - Pupils' Answer Sheet.

TEACHERS' INSTRUCTIONS

N.B. It is absolutely essential that the Open-Ended Test (i.e. where the pupils note down all they can remember about the city of Kano) is given BEFORE the Multiple Choice Test.

Hand out to pupils, face down, the Open-Ended Test (2 stapled sheets: one with instructions at the top, the other completely blank).

Say: "This is a test to see how much you can remember from the passage about the city of Kano which you read 3 weeks ago."

"Turn your sheets over and follow the instructions as I read them aloud."

Continue: "You have 20 minutes to do this test. Are there any questions?"

Answer questions which may arise.

Say: "Remember you have 20 minutes in which to do this test. You may begin now."

Call time after 10 minutes, 15 minutes and 20 minutes ('time up').

Collect in test papers.

Check that all pupils have their name on their answer paper.

Hand out, face down, the Multiple Choice Instruction and Question booklets, and the Answer Sheets.

Say: "Turn your papers over and follow the instructions as I read them aloud." +

+ (Give pupils time to fill in the 'sample question'.)

After you have cleared up any questions which may arise, ask pupils to check that they have all 20 questions on their question sheets.

Say: "Remember you have 20 minutes to do this test; you may begin now."

Call time after 10 minutes, 15 minutes and 20 minutes ('time up').

Say: "Check that you have your name on your answer sheet."
"Put your pens down."

Collect in answer sheets first. (This reduces the chance of cheating while papers are collected.)

TEST

THE GREAT MUD CITY OF KANO

NAME: _____ ROOM: _____

Note down on these two pages all you can remember about the mud city of Kano.

You do not have to write complete sentences. You can write it down in note form.

You must note down everything you can remember about the city of Kano.

(A blank page was provided for
pupils' answers.)

TEST

THE GREAT MUD CITY OF KANO

This is a test to see how much you can remember from the passage about the city of Kano which you read 3 weeks ago.

You are to answer all twenty (20) questions. Four possible answers are given for each question. You are to choose the ONE correct answer for each question.

Here is an example:

S.1. Outside the wall of the old city of Kano is
(A) a modern town
(B) an area where visitors pitch their tents
(C) a forested area
(D) an area which the Hausa plant in crops

The correct answer is 'a modern town'. You will see that 'a modern town' has the letter (A) in front of it. Now look at the answer sheet. Beside S.1. write the letter 'A' in the brackets. This is how you will answer the questions. In the brackets ( ), just print the letter of the answer you choose.

Answer every question even when you are not sure of your answer. Do not spend too much time on questions you find hard. You have 20 minutes to complete the test.

Do not start until you are told.
Do not mark the question sheets.
Are there any questions?

1. The city of Kano is in
   (A) Rhodesia
   (B) Nigeria
   (C) Ethiopia
   (D) Kenya

2. The distance around the city wall is about
   (A) 8 miles
   (B) 12 miles
   (C) 15 miles
   (D) 18 miles

3. The Hausa people are famous as
   (A) craftsmen and merchants
   (B) warriors and spearsmen
   (C) camel breeders
   (D) food growers

4. The wall was built so that there was space inside to allow
   (A) for expansion of the city
   (B) crops to be grown
   (C) large houses to be built
   (D) for extra fortifications

5. The wall was made of
   (A) mud
   (B) rocks
   (C) mud and rocks
   (D) mud and wood

6. What in the passage was said to look like 'upturned tins and cardboard boxes'?
   (A) the market stalls
   (B) the officials' offices
   (C) the houses
   (D) the bike sheds

7. The rafters of their houses are made of a special kind of palm because it
   (A) will bend to fit the shape of the roof
   (B) is the only wood strong enough
   (C) is the only wood available
   (D) is too hard for the ants to eat

8. So that the walls of the houses do not dissolve in heavy rain
   (A) the houses have gutter-pipes to channel the water
   (B) the walls are coated with a special clay
   (C) the roofs jut out past the walls
   (D) the walls are covered in palm leaves

9. In the market place at Kano you would see
   (A) many animals
   (B) no animals
   (C) only camels
   (D) only donkeys

10. Many of the Hausa are dangerous on their bikes because
   (A) they try to show off
   (B) they have not learnt to ride properly
   (C) they carry an umbrella in one hand
   (D) their bikes have no brakes

11. The Hausa leave some of the wrapping paper on their bikes because they
   (A) think it will bring them good luck
   (B) think it makes the bikes stronger
   (C) don't like to show off the bright colours
   (D) think it is the best way to keep their bikes clean

12. To help those people who get punctures
    (A) there are service stations which fix bikes
    (B) a puncture kit is supplied with every bike
    (C) there are puncture menders on the side of the road
    (D) a spare tube is supplied with every bike

13. Garbage in Kano is
    (A) collected by bike trolleys
    (B) collected by donkey cart
    (C) buried in a large hole
    (D) thrown into the streets

14. Nobody kills the vultures in Kano because
    (A) the vulture is a sacred animal
    (B) the vulture is too dangerous
    (C) the vultures do an important job
    (D) nobody has a suitable weapon

15. The Hausa are
    (A) the older people of Kano
    (B) the working class of Kano
    (C) the native people of Kano
    (D) those who ride bikes in Kano

16. The rainy season for the people of Kano is
    (A) in December and January
    (B) in March and April
    (C) in May and June
    (D) in September and October

17. In the centre of the city of Kano there is
    (A) a tall look-out tower made of mud
    (B) a busy market place
    (C) an open space for herding the animals
    (D) a beautiful Moslem mosque

18. The wall around the city of Kano is
    (A) small enough for people to step over it
    (B) about the height of an average man
    (C) just a little taller than the houses
    (D) very much higher than the houses

19. The roofs of the houses are
    (A) completely flat
    (B) round and pointed like a cone
    (C) square and sloping like our houses
    (D) rounded like a round dome

20. The country around the city of Kano is mostly
    (A) flat grassy fields used for pasture
    (B) mountainous hills and valleys
    (C) dense jungle forest of tall trees
    (D) dry open plains covered in thorn-scrub

TEST

THE GREAT MUD CITY OF KANO

NAME: _____ ROOM: _____

ANSWER SHEET

Sample Answer
S.1. ( )

1. ( )	11. ( )
2. ( )	12. ( )
3. ( )	13. ( )
4. ( )	14. ( )
5. ( )	15. ( )
6. ( )	16. ( )
7. ( )	17. ( )
8. ( )	18. ( )
9. ( )	19. ( )
10. ( )	20. ( )